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The Engineer.

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VOL. CXXXII.—No. 3422] LONDON: FRIDAY EVENING, JULY 29, 1921 [PRICE ONE SHILLING BY INLAND POST 1s. 3d.

PUBLIC NOTICES

Civil Engineer Required by the GOVERNMENT of NYASALAND for service as an ASSISTANT ENGINEER in the Public Works Department, for one tour of twenty to thirty months, with prospect of extension. Salary £500 per annum for the first three years, thereafter rising by annual increments of £25 to £600 per annum. Outfit allowance of £30 paid on first appointment. Free quarters and first-class passages. Liberal leave in England on full salary. Candidates, under 30, preferably single, must be A.M. Inst. C.E. or hold an equivalent university engineering degree, and must have had good experience on road survey and construction.—Apply at once, in writing, giving age and brief details of experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting M/Nyasaland, 10,970. 5750

Royal Navy. APPLICATIONS are INVITED for APPOINTMENTS as INSTRUCTOR LIEUTENANTS in the Royal Navy.

Candidates must be under 30 years of age, have had a University training, and have taken an Honours Degree in Mathematics, Science or Engineering.

Present rates of pay are from £365 per annum on entry to a maximum of £940 per annum as Instructor Commander. Promotion, by selection, to Instructor Captain is also open, with a maximum of £1277 per annum.

Retired pay, to officers over 40 years of age, after 12 years' service, ranges from £200 per annum for an Instructor Lieutenant to a maximum of £900 for an Instructor Captain, according to length of service. Service pension is also allowed to officers if invalided before becoming eligible for retired pay.

Service victualling, cabin accommodation, and servant are provided.

In cases where it is not possible to provide these the following allowances are paid in lieu:—

Victualling allowance, £50 per annum.

Lodging allowance, £80 to £100 per annum, according to rank.

Servant allowance, £30 to £60 per annum, according to rank.

For further particulars apply in the first instance to THE SECRETARY OF THE ADMIRALTY, Whitehall, S.W. 1. 5509

Finsbury Technical College,
LEONARD-STREET, CITY-ROAD, E.C. 2.
Dean for the Session 1921-22, Professor W. H. ECCLES, D.Sc., F.R.S.

The College provides for the Scientific Training of Students who desire to become Civil, Mechanical or Electrical Engineers or Chemists.

A certificate of proficiency is awarded by the Institute to students who satisfactorily complete a two years' course of instruction, and the Diploma of the College is awarded to students who attend a three years' course and who pass the prescribed Examinations with distinction.

Candidates are required to pass an Entrance Examination in Mathematics and English, but the Matriculation Certificate of any British University and certain other qualifications are accepted by the Institute in lieu of the Entrance Examination. The Entrance Examination for the Session 1921-22 will be held on Tuesday, September 20th next. Applications for admission should be forwarded to the College not later than the 15th September, on forms to be obtained from the REGISTRAR, Leonard street, City-road, E.C. The programme of the College is under revision and will be issued in due course. 5716

University of Birmingham.
FACULTY OF SCIENCE.
ENGINEERING DEPARTMENTS.

I.—MECHANICAL ENGINEERING.
Chance Professor: F. W. BURSTALL, M.Sc., M.A. (Cantab), M. Inst. C.E., M. Inst. M.E.
Lecturer: R. C. PORTER, M.Sc. (Vict.), A.M. Inst. C.E.
Demonstrator: S. J. ELLIS, A.M.I.C.E.
Lecturer on Machine Design: F. H. BODEN.
Assistant Lecturer on Machine Design: HENRY BAKER, B.Sc.

II.—CIVIL ENGINEERING.
Beale Professor: FREDERICK C. LEA, M.Sc., D.Sc. (Lond.), A.M.I.C.E., A.R.C.S.
Lecturers: R. C. PAPTON, M.Sc.
R. E. STRADLING, B.Sc., A.M.I.C.E.
H. W. COULTAS, B.Sc.
Lecturer on Town Planning: W. HAYWOOD.

III.—ELECTRICAL ENGINEERING.
Professor: WILLIAM CRAMP, D.Sc.
Lecturer: E. J. KIPPS, M.Sc., M. Inst. E.E.
Assistant Lecturers and Demonstrators: O. R. RANDALL, B.Sc.
H. VICKERS, M.Eng.
G. M. HARVEY, B.Eng.

The FULL COURSES EXTEND OVER FOUR YEARS, and Students who enter after Matriculation and pass successfully the Examinations at the end of each year will be ENTITLED TO THE DEGREE OF BACHELOR OF SCIENCE in Engineering.

The SESSION 1921-22 COMMENCES on OCTOBER 3rd, 1921.

For detailed syllabus of the Faculty with full particulars of University Regulations, Lecture and Laboratory Courses, Fees, &c., apply to the SECRETARY. 5715

City and Guilds (Engineering) COLLEGE.

There are TWO VACANCIES in the Mechanical Engineering Department for DEMONSTRATORS in ENGINEERING SCIENCE. Salary £300.—Apply in the first instance to Professor W. E. DALBY, F.R.S., City and Guilds (Engineering) College, Exhibition-road, London, S.W. 7, before Wednesday, August 3rd. 5733

City and Guilds (Engineering) COLLEGE.

There is a VACANCY in the Mechanical Engineering Department for a DRAUGHTSMAN with special experience in the Design of Locomotives and Internal Combustion Engines. Salary £250 per ann.—Applications, stating age, technical education and experience, should be made in the first instance to Prof. W. E. DALBY, F.R.S., City and Guilds (Engineering) College, Exhibition-road, S.W. 7, by August 3rd. 5755

University of London, University College.

The College Committee will shortly APPOINT an ASSISTANT to the CHADWICK PROFESSOR of MUNICIPAL ENGINEERING (Mr. M. T. M. Ormsby). Commencing salary £300. University training and some experience of Municipal Engineering required.—For duties, &c., apply to
WALTER W. SETON, M.A., D.Lit.,
Secretary.
University College, London,
Gower-street, W.C. 1. 5721

The Engineer

PRINCIPAL CONTENTS OF THIS ISSUE.

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Locomotive Operation.
London's Electricity Supply Problem.—No. VII.
Municipal Electrical Engineers' Meeting.
The Newcomen Memorial.
New L. & S.W. Trains for the Bournemouth Service.
Alternating Stress Testing Machine.
The Electrification of Railways.
Mechanical Reversing Drive for Planing Machines.
A Reinforced Concrete Road.

PUBLIC NOTICES

Leyton Higher Education Committee.
LEYTON TECHNICAL INSTITUTE.

WANTED, a WORKSHOP INSTRUCTOR at Leyton Technical Institute, Adelaide-road, Leyton, E. 10.

Commencing salary from £250 to £300, according to experience and qualifications.

Experience of modern engineering works in fitting, turning, grinding, &c., essential. Work in a modern tool-room, together with some machine experience, an advantage.

Applications to be returned not later than 15th August.

For form of application send stamped addressed envelope to
R. J. GELDART,
Clerk to the Governors.
Town Hall, Leyton, E. 10. 5727

London County Council.

REQUIRED in September next, the undermentioned teaching staff:—

PERMANENT WHOLE-TIME TEACHERS.

CHOOL OF BUILDING, FERNDALE-ROAD, CLAPHAM, S.W.

(1) MECHANICS. Candidates should possess a good honours university degree or its equivalent, but the qualification will not be insisted on in the case of applicants otherwise exceptionally qualified. Salary £225 to £315, according to experience and qualifications, rising by annual increments of £15 to £330 a year, thence by annual increments of £10 to £440 a year.

SCHOOL OF ENGINEERING AND NAVIGATION, HIGH-STREET, POPLAR, E.

(2) WORKSHOP INSTRUCTOR. Training and experience in engineering work essential. Teaching experience desirable. Salary £275-£285 a year, according to experience, rising by annual increments of £10 to £340 a year.

VISITING TEACHER.

HACKNEY INSTITUTE, DALSTON-LANE, N.E.

(3) ENGINEERING SUBJECTS. Three attendances a week. Fee 15s. an attendance of about three hours. Thorough knowledge of mechanics and mathematics as applied to engineering, and ability to lecture and take laboratory work essential.

Salaries and fee are subject to revision on issue of Burnham Award and, at present, to temporary additions conditionally: (1) £19 a month, (2) £8 a month, (3) 20 per cent. of fee.

Preference given to candidates who have served or attempted to serve with H.M. Forces. Apply to Education Officer (T.1a), Education Offices, Victoria Embankment, W.C. 2 (stamped addressed foolscap envelope necessary), for form of particulars, to be returned by 11 a.m. on 26th August, 1921.

A separate form must be used for each position applied for.

Canvassing disqualifies.

JAMES BIRD,
5701 Clerk of the London County Council.

The University of Sheffield.
FACULTY OF ENGINEERING.

APPLICATIONS are INVITED for the POST of ASSISTANT LECTURER in MECHANICAL ENGINEERING.

Salary £400 per annum, including evening work during Winter Session. Candidates holding a University Degree with Honours in Mechanical Science preferred.

Applications, stating particulars of training and experience, accompanied by three testimonials, should be sent not later than August 20th to the undersigned.

W. M. GIBBONS,
5472 Registrar.

PUBLIC NOTICES

Ministry of Education, Egypt.
DEPARTMENT OF TECHNICAL, INDUSTRIAL AND COMMERCIAL EDUCATION, CAIRO.

APPLICATIONS are INVITED for the POST of PRINCIPAL of the SCHOOL OF ENGINEERING, GIZEH (a Higher College), which will be vacant from October 1st next.

High academic and professional qualifications, together with responsible University and Professorial experience, are desired.

The salary proposed is £E1200 to £E1440, with free residence, but the Selection Committee will be prepared to recommend an increase on this for an exceptionally qualified and experienced candidate.

Before making formal application, intending applicants should obtain from G. ELLIOT, Esq., Director, Egyptian Educational Mission, 28, Victoria-street, London, S.W. 1, a copy of the Note, giving further particulars of the position, together with instructions for applying.

July 1st, 1921. 5619

Edinburgh Corporation Electricity Supply.
PORTOBELLO STATION.

The Lord Provost, Magistrates and Council invite TENDERS for the following WORKS:—

SPECIFICATION No. 37.—Contract relating to Open Cuttings and Tunnel between the Power Station Site and Coal Sidings Site, including the Construction of a Coal Bunker and Access Shaft, and the Earthworks for Coal Sidings and the Laying of Permanent Way and Ballasting for same.

A copy of the specification, conditions of contract and drawings can be obtained from the Engineer, Dewar-place, Edinburgh, on or after August 1st, 1921, upon payment of a deposit of Three Guineas.

An additional copy of the specification and drawings can be obtained upon payment of a deposit of Two Guineas. These deposits will be returned after the receipt of a bona fide Tender and on return of the specifications and drawings.

Tenders, on the prescribed form, enclosed in sealed envelopes, addressed on the outside "Electricity Supply. Tender to Specification No. 37," must be delivered at the office of the undersigned not later than the 29th August, 1921, at 10 a.m.

The Council do not bind themselves to accept the lowest or any Tender.

A. GRIERSON, S.S.C.,
Town Clerk.
City Chambers, Edinburgh,
28th July, 1921. 5730

The Metropolitan Asylums Board invite TENDERS for the OPENING UP, REPAIRING and CLOSING UP the ENGINES, &c., of the RIVER AMBULANCE STEAMER "GENEVA CROSS," in accordance with specification prepared by Mr. Thomas Cooper, M.I.C.E., Engineer-in-Chief to the Board.

Specification, conditions of contract, and form of Tender may be obtained at the office of the Board, Embankment, E.C. 4.

Tenders, addressed as noted on the form, must be delivered at the office of the Board not later than 10 a.m. on Wednesday, 10th August, 1921.

DUNCOMBE MANN,
Clerk to the Board.
27th July, 1921. 5756

The National Foremen's Association of the ENGINEERING AND ALLIED TRADES.
(Registered under the Trade Union Act.)

An Association specifically formed to look after the interests of Foremen in their Supervisory Capacity. All communications to Head Offices,
R. W. REID, 95, Belgrave-road,
General Secretary. Victoria, S.W. 1.
Ex.

PUBLIC NOTICES

PATENTS AND DESIGNS ACTS, 1907 AND 1919.
HEATING STOVES.

The Proprietor of British Patent No. 120,212 of 1918 is PREPARED to SELL the PATENT or to LICENSE British manufacturers to work under it.

It relates to domestic heating stoves for burning sawdust, in which air enters below a stepped grate at the bottom of an air-tight receptacle and the distillation gases pass downwardly through the fuel and burn under the grate.

Address,
BOULT, WADE and TENNANT,
111/112, Hatton-garden,
5707 London, E.C. 1.

PATENTS AND DESIGNS ACTS, 1907 AND 1919.
DRYING AND SUPERHEATING STEAM.

The Proprietor of British Letters PATENT No. 15,104 of 1914 is PREPARED to SELL the PATENT or to LICENSE British manufacturers to work under it. It relates to means for drying and superheating steam.

Address: BOULT, WADE and TENNANT,
111 and 112, Hatton-garden,
5708 London, E.C. 1.

PATENTS AND DESIGNS ACTS, 1907 AND 1919.
HORSE-DRAWN VEHICLES.

The Proprietor of British Letters PATENT No. 20,279 of 1910 is PREPARED to SELL the PATENT or to LICENSE British manufacturers to work under it. It relates to fifth wheels for horse-drawn vehicles, and comprises two complete rings fitting one into the other so that the forecarriage is pivotable, but cannot become separated from the carriage body; no king pin is used.

Address: BOULT, WADE and TENNANT,
111 and 112, Hatton-garden,
5709 London, E.C. 1.

The Institution of Civil Engineers.

The Council invite ASSOCIATE MEMBERS who are under 30 years of age and STUDENTS of the Institution to SUBMIT DESIGNS in competition for a Charles Hawksley Prize, 1921, which is offered for proficiency in the Design of an Engineering Structure combining artistic merit with excellence of constructional design.—Particulars of the competition may be obtained from the SECRETARY, the Institution of Civil Engineers, Great George-street, Westminster, S.W. 1. P3721

For Immediate Sale, Two Horizontal TANDEM COMPOUND CONDENSING STEAM ENGINES, built by the Glenfield Company, Kilmarnock, about 1886; cylinders 15in., 23in. dia., 27in. stroke, 100 lb. per sq. in. working pressure, 70 rev. p.m., 150 rated H.P. Expansion valve on both H.P. and L.P. cylinder, bayonet type frames. Engines can be run separately or coupled together by existing coupling.

Also FLY-WHEEL, 8ft. dia. by 16in. face, metallic packed piston-rod stuffing-boxes.

Also ONE SURFACE CONDENSER, approximately 220 sq. ft. surface, tubes 2in. external diameter.

Also SMALL PUMPS and C.I. STEAM PIPING, BELTS, &c.

The machinery is the property of the Grimsby Corporation and is in excellent condition.—Complete specification and permission to inspect can be obtained from H. GILBERT WHYATT, M. Inst. C.E., Borough Engineer, 170, Victoria-street, Grimsby. 4722

Ministry of Public Works,
PHYSICAL DEPARTMENT.

APPLICATIONS are INVITED for TWO POSTS of INSTRUMENT MECHANIC at salaries of from £E288 plus 20 per cent. per annum to £E336 plus 20 per cent., according to qualifications, and such additional war gratuity as may be in force.

Candidates must have had experience in the repair of electrical instruments generally and X-ray apparatus in particular, or in the repair of calculating machines, such as the Hollerith tabulating machine and the Burroughs and Comptometer adding machines. Some knowledge of instrument design is also desirable.

The appointments will be on contract for a period of two years. An allowance for passage to and from Egypt will be made.

Further information can be obtained from the CONTROLLER, Physical Department, Cairo, to whom applications, together with testimonials and statements of qualifications, should be addressed before September 1st, 1921. 5719

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PUBLIC NOTICES

South Indian Railway Company, LIMITED.

APPLICATIONS are INVITED from duly qualified candidates for SEVERAL VACANCIES for ASSISTANT ENGINEERS on the Company's Staff in India.

Candidates, who may be between the ages of 24 and 30 years, must have received a sound general and technical education, followed by pupilage with a civil engineer engaged on construction work, or as engineer to a British Railway Company.

Candidates must have also passed the Associate Membership Examination of the Institution of Civil Engineers, or have taken a degree exempting from such examination. One of the vacancies is for an Officer in Charge of the Drawing-office, candidates for which should, in addition, have had a sound training in a drawing-office and be a capable mathematician.

The terms of the appointments are a three years' agreement in the first instance, commencing on a salary of 450 rupees per mensem and rising by annual increments of 50 rupees per mensem for each year of approved service to 800 rupees in the eighth year. The Company will provide a first-class passage to India, and the salary will commence from the date of sailing.

Preference will be given to candidates who have had railway experience or who have served during the late war.

Applicants must give a full chronological record of their career, stating whether they are married or single, including details of their education, training and subsequent civil or military experience, and state for which appointment they apply.

Applications must be addressed to the Company's Consulting Engineers, Messrs. ROBERT WHITE and PARTNERS, 3, Victoria-street, Westminster, S.W. 1. 5738

SITUATIONS OPEN

BOILER-HOUSE ENGINEER, Technical Training, able to Work Out Heat Balances, WANTED by Yorkshire Manufacturing Firm. State age, training, experience, salary.—Address, 5666, The Engineer Office. 5666 A

COMMERCIAL ENGINEER of Proved Ability to Act as GENERAL MANAGER for company employing 1000 hands on Engine Building; Works Management Experience combined with good Technical Knowledge essential. Progressive position with seat on the Board later if successful.—Address, 5814, The Engineer Office. 5814 A

ELECTRICAL ENGINEER of Good Address WANTED, to Take Charge of Electrical Dept. of Engineering Firm in Malaya.—Must have had sound technical and commercial training, be capable of preparing competitive schemes and estimates for, and superintending installation of, all classes of Lighting and Power Plants from small domestic sets to small town lighting plants, including house wiring, also Factory and Mine Equipment. Life, &c. Will be required to take charge of and push sales of cables, fittings, lamps, &c. Healthy situation. Good prospects to suitable man with initiative. Progressive salary, commencing about £50 per month (free of income tax).—Address, giving full particulars of experience and qualifications, age, &c., with copies of recent testimonials, 5711, The Engineer Office. 5711 A

ENERGETIC COMMERCIAL ENGINEER (About 25 years) REQUIRED by small old-established firm of Brassfounders and General Engineers, 30 miles from London. Good sales experience and commercial ability essential; also qualifications and experience in one or more of the following departments desirable: Metallurgy, Foundry Practice, Works Costing and Production, Drawing-office Experience, Steam and Water Fittings, Brewery Plant. Reply in strict confidence, stating age, full particulars, when disengaged, and salary required to commence.—Write, Box 2278, Willing's, 125, Strand, W.C. 2. 5785 A

HEATING and VENTILATING ENGINEER REQUIRED by London Firm. Previous technical and commercial experience essential and knowledge of the Plenum System desirable.—Address, giving particulars of experience, age and salary required, 5737, The Engineer Office. 5737 A

MACHINE TOOL SALESMAN REQUIRED: Must be capable of demonstrating and have minute knowledge and connection in definite district. Send details, salary expected, and experience. Knowledge of English and particularly American machines essential.—Address, 5718, The Engineer Office. 5718 A

REQUIRED by a Leading Insurance Company, BOILER INSPECTORS, with first or extra first-class Board of Trade certificate. Age about 30. Association rate of salary paid.—Write, Box 966, Smith's, 5, Lincoln's Inn-fields, London, W.C. 2. 5745 A

ROAD SURVEYOR.—WANTED by the Eastern District Committee of Perth County Council, experienced MAN to Assist Road Surveyor. Salary £200 per annum, with allowance for motor cycle.—Applications, with references and stating age and experience, to be lodged with the JOINT DISTRICT CLERKS, Blairgowrie. 5682 B

SECRETARY-DIRECTOR REQUIRED for Old-established, well-known Limited Company, London, engaged in Manufactures; preference to one with some Engineering Knowledge. Investment £1000. Salary £600 p.a., plus dividends. Open to solicitors' and accountants' investigation.—Write, Box 450, Sells, 167, Fleet-street, E.C. 4. 5736 A

SMALL TOOLS, ACCESSORIES AND ENGINEERS' REQUISITES.—Experienced SALESMAN REQUIRED for London. State salary, age, previous engagements. Replies kept confidential.—Address, 5760, The Engineer Office. 5760 A

COMPETENT DRAUGHTSMAN REQUIRED, Capable of preparing full working drawings for line of Feed and Marine Pumps.—Apply, stating salary required, to ASTER ENGINEERING COMPANY, Wembley. 5705 A

DRAUGHTSMEN REQUIRED for Automobile Work. Preference will be given to those with either Commercial Vehicle Knowledge or High-class Light Car Design and to those who are fully capable of conducting their own calculations. North London district.—Address, stating age, experience and salary required, with copies only of testimonials, 5748, The Engineer Office. 5748 A

FIRST-CLASS DRAUGHTSMAN, with Thorough knowledge of Lay-out and Erection of Bakery and similar Machine Plants, REQUIRED.—State experience and wages to J. H. P., Westwood Works, Peterborough. 5740 A

JUNIOR DRAUGHTSMAN (Used to Automobile or similar Work) WANTED. Wages, including Civil Service bonus, 60s. to 80s. per week.—Apply in writing to SUPERINTENDENT, Tank Design and Experiment, Charlton House, Old Charlton, London, S.E. 7. 5722 A

HEATING DRAUGHTSMAN REQUIRED: Able to set out own schemes, quantities, and estimates.—Address, stating age, experience, and salary required, 5726, The Engineer Office. 5726 A

CHARGE HANDS (2) REQUIRED for Power-house on Mine in India. Three years' agreement, passage both ways and expenses and free quarters at the mine. Applicants to send full particulars, including age, copies of testimonials, mechanical and electrical experience, and wages required.—Address, 5761, The Engineer Office. 5761 A

LADY SECRETARY WANTED by Engineer in North Kent. Rapid shorthand and good office experience essential; some technical knowledge useful. Apply by letter, giving full particulars of education and experience, and stating age and salary required.—Address, 5759, The Engineer Office. 5759 A

PUBLIC NOTICES

JUDICIAL SALE

of assets of

The Dominion Shipbuilding and Repair Company, Limited.

In the matter of The Dominion Winding up Act,
and in the matter of The Dominion Shipbuilding and Repair Company, Limited.

SEALED TENDERS will be received, addressed to J. A. C. Cameron, Official Referee, Osgoode Hall, Toronto, and marked "Tenders in the matter of The Dominion Shipbuilding and Repair Company, Limited," up to Wednesday, the Thirty-first day of August, 1921, for the purchase of the assets en bloc of the above-mentioned Company.

The assets consist of:—

Real Estate Leasehold.

Being part of Block G, according to a plan registered in the Registry Office for the Registry Division of West Toronto, as Number D-1397, containing 13,353 acres, and more fully set out in lease between The Toronto Harbor Commissioners and the above Company, for forty-two years, from 1st July, 1919, at an annual rental of $22,100.00 for the first twenty-one years, and taxes and rates, and for the second twenty-one years, such rental as the premises shall be worth on the first day of July, 1940. This lease also contains a provision for the renewal thereof, at the conclusion of any term of twenty-one years, in accordance with the terms and provisions contained therein. This leasehold land embraces approximately 1868 feet of water front, with 5 permanent shipways, equipped with 3 electrical travelling gantry cranes and 1 set of sheer legs 100 tons lifting capacity.

Erected upon the aforesaid lands are three main buildings—

(1) Punch and Joiner Shop: The Punch Shop section is 200 feet by 225 feet, and is made up of 4 bays, each equipped with a 3-ton electric travelling crane, and includes the oil furnace equipment, the bending slabs, the angle iron smith shop, the rivet manufacturing plant, with separate furnace and rivet stores. It is fully equipped with fabricating machinery said to be capable of producing approximately 75 tons of steel per nine-hour day. The Joiner Shop section is 110 feet by 185 feet, and includes the air tool room, the power plant, hospital and lavatories and warehouse, with second floor full length used as a mould loft. These buildings are constructed of structural steel, with reinforced concrete walls, and the Punch Shop section is divided from the Joiner Shop section by an approved fire wall for insurance purposes.

(2) Machine Shop Building is 275 feet by 110 feet, built of structural steel, with hollow tile side walls and built-up roofing. This building includes the pipe shop, with electrical shop and pattern shop overhead, and also the blacksmith and forge shop. The machine shop proper has 3 bays, equipped with two 3-ton and one 15-ton electric travelling cranes. This building is fully equipped with modern and up-to-date machinery necessary for general machine shop operations, but particularly fitted for the production of marine engines.

(3) Main Office Building, 3-storey solid brick building, slate roof, equipped with separate hot water heating. The ground floor takes in the main offices and time office. The second floor takes in Draughting Office, Lunch Room and Janitor's Apartments. The third story is used for a blue printing room and general store room.

The estimated capacity of the plant for shipbuilding purposes is 10 to 12 vessels per year, and is said to be the most modern shipyard in the Dominion.

Power Plant.—The plant is equipped throughout with compressed air developed from the Electrical Power House, said to have a capacity of 4500 cubic feet per minute.

The buildings and plant were erected during 1917-18, and are of entirely new construction, representing an investment (inventory value) as follows:

Buildings and yard construction	$637,215.52
Machinery and equipment	932,934.44
Total inventory value	$1,570,149.96

Terms of sale are 25% of the amount tendered on the acceptance of the tender, and the remainder will be arranged on special terms, with seven per cent. interest, secured to the satisfaction of the Liquidator.

Tenders will be opened at the office of the Official Referee on Wednesday, the 31st day of August, 1921, at eleven o'clock in the forenoon, and all tenders are requested to be then present.

All tenders must be accompanied by a marked check payable to the Liquidator for 5% of the amount of the tender, which will be returned if the tender is not accepted, and forfeited if the tender is accepted and not completed by the purchaser.

The highest or any other tender not necessarily accepted.

The other conditions of sale will be the standing conditions of sale of the Court, so far as applicable.

Further particulars as to the property, inventory and encumbrances may be had on application to the Liquidator or his solicitors.

DATED at Toronto, Canada, this 14th day of June, 1921.

OSLER WADE, Liquidator,
32, Front Street, W., Toronto, Canada.

McMASTER, MONTGOMERY, FLEURY & CO.,
901, Temple Bldg., Toronto, his solicitors. 5533

SITUATIONS WANTED

ADVERTISER, Englishman, 49 Years of Age, Mechanical engineer, OPEN to ENGAGEMENT as MANAGER or TRAVELLING REPRESENTATIVE abroad. Many years manager of shipbuilding and engineering works abroad; commercial experience and command of Russian, Swedish and German languages.—Address, P3751, The Engineer Office. P3751 B

BUYER TO MANUFACTURING ENGINEERS.—MANAGER of Central Purchasing Organisation, market experience extending over many years, is OPEN to ACCEPT NEW APPOINTMENT; would undertake installation of central system of buying for associated companies or departmental re-organisation in single-unit works.—Write, E.Y. 202, c/o. Deacons, Leadenhall-street, E.C. 3. 5663 B

CIVIL ENGINEER, Age 23, Sound Knowledge of all classes of building construction, reinforced concrete, surveying, &c., also thorough knowledge of cement making, except works management and machinery, experienced in managing all classes of labour, SEEKS RE-ENGAGEMENT, home or abroad.—Address, P3742, The Engineer Office. P3742 B

CIVIL ENGINEER, in Private Practice, DESIRES to PLACE his SON with a Corporate Member of the Institution of Civil Engineers as PUPIL. Railways, Bridges or Harbour Works.—Address in first instance, P3729, The Engineer Office. P3729 B

CIVIL ENGINEERING ASSISTANT and DRAUGHTSMAN, good experience and references, SEEKS APPOINTMENT in London.—MOORE, 148, Wellesley-road, Ilford. P3752 B

COMMERCIAL ENGINEER (37), Ex-manager of Brazilian branch (closed owing to slump) of well-known trading firm, DESIRES Home or Colonial POSITION with engineering firm.—Address, P3736, The Engineer Office. P3736 B

CONTRACTOR'S ENGINEER, A.M.I.C.E., Completing Government contract for London firm of civil engineering contractors, is PREPARED to TAKE UP new APPOINTMENT; 16 years experience U.S.A., large reservoirs, earthwork and masonry dams, deep trench work, tunnel sewers, power shovelling, and G.P.O. duct work; familiar with present conditions of labour and material; take full charge.—Address, P3744, The Engineer Office. P3744 B

ENGINEER, A.M.I. Mech. E. (35), DESIRES POSITION, home or abroad. Extensive experience and specialist in des'g, constr'g, erect'g, maintain stone-brk'g, crush'g, pulver'g, screen'g, elev., conv., conser., tarred mac. plants, colliery, cement and chem. wks. plants.—Address, P3745, The Engineer Office. P3745 B

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For continuation of Small Advertisements see page iii.

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Modern Marine Oil Engines.

No. IV.*

THE 2330 INDICATED HORSE-POWER NORTH BRITISH TYPE.

IT must be admitted that in the early days of Diesel engine development British shipbuilders were frankly sceptical of the prospects of its successful application to marine propulsion on a large scale. The first steps were taken by the Scandinavians and the Dutch, and it was not until after they had achieved a fair measure of success that any real progress was made in this country. The fact that out of a total of nearly 200 motor ships, with a gross tonnage of 500,000, nearly half that number, representing a quarter of a million tons of shipping, are being built in this country, shows how rapidly British shipbuilders forged ahead when they came to the conclusion that the motor ship represented a real commercial proposition. It is perhaps still more satisfactory to record that engineers in this country did not copy continental designers when they took up Diesel engine construction, but in many cases struck out for themselves along fairly novel lines, with the result that there are now probably more Diesel engines of British design than of any other country.

The North British Diesel Engine Works were among firms which developed their own type without external assistance. Like Harland and Wolff, they are in the fortunate position of possessing a works which was designed and equipped for the exclusive manufacture of Diesel engines, and it needs but little knowledge of marine oil engine practice to realise what an immense advantage that confers upon the builders. It is only force of circumstances which has caused some manufacturers to construct marine Diesel engines in shops originally intended for reciprocating steam engine and steam turbine construction, and all who have had experience of work carried out in this manner will agree that ultimately oil engine building must be looked upon as a specialised branch of industry. The North British works were probably the first to be established in this country for this particular purpose, and although, owing to the exigencies of war, they were utilised for other classes of manufacture, they are now solely employed on the construction of marine Diesel machinery and the auxiliary plant for motor ships.

The North British Diesel engine, of which we are about to give a description, is of the four-cycle type, although we understand the builders do not look upon this as representing the last word in marine oil engine construction, and we may look forward to some interesting developments in connection with two stroke double-acting engines from them in the future. The first engine—of which Fig. 12 is an illustration—is, however, one which has required no long experimental work, and, in fact, immediately the design was prepared it was standardised and six sets were put in hand, four of them being for twin-screw installations in two mixed cargo and passenger liners for the British India Steam Navigation Company. The machinery installation in the first of these two vessels, the Domala, is now being carried out after successful trials had been run on the engines on the test bed.

The North British standard engine is designed to develop 2330 indicated horse power at 96 revolutions per minute, this somewhat curious figure being due to the requirements of the shipowners who specified with the twin-screw installation that a power should be developed equivalent to 4500 steam indicated horse-power. A Diesel engine driving its own air injection compressor, absorbing, perhaps, 10 per cent. of the power, would not give the equivalent of 2250 steam indicated horse-power if its own output were 2330 indicated horse-power, on account of the low mechanical efficiency of the Diesel engine compared with the steam plant. As the builders did not wish to adopt larger cylinders than those they

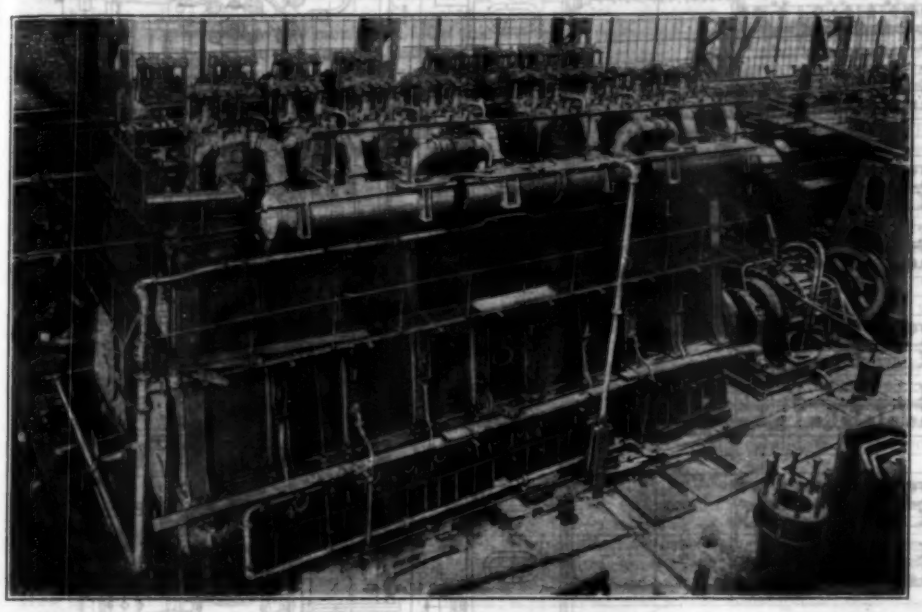


FIG. 12—2330-I.H.P. NORTH BRITISH DIESEL ENGINE

employed—namely, 26½in. bore by 47in. stroke—they decided to obtain the necessary high mechanical efficiency with a correspondingly large shaft horse-power by eliminating the air compressor from the main engine and driving it separately by means of an auxiliary Diesel engine. So far as our knowledge goes, this is the first time that such an arrangement has been employed, and were it not for the specific reason given we should be inclined to regard it as undesirable chiefly from the standpoint of additional cost involved and the extra machinery which has to be kept continuously running in the engine-room. Except in the first two engines, however, we understand that the normal arrangement will be used, the engines thus developing the same indicated horse-power but a lower shaft horse-power.

What for want of a better term may be called the "group" system of construction is adopted, now favoured by most manufacturers of four-cycle machinery. Each set of four cylinders forms one unit, the cylinders being bolted together in the manner indicated in the illustration, thus affording an entablature carried by vertical steel tie bolts arranged over the bearings. The frames, which take no stresses, are comparatively light, and the engine is entirely enclosed between them, inspection doors being arranged on one side.

As might be anticipated from the need for high mechanical efficiency, no auxiliary pumps are driven off the main engine, but in any case this is a tendency to be noted in the majority of marine Diesel motors. Circulating water, piston cooling water, and lubricating oil pumps are all operated from electric motors, for although sea water is utilised both for cooling the pistons and the cylinders, the higher pressure in the former renders a separate pump desirable. The piston cooling arrangements are normal, the ordinary jet system with a dipping pipe being employed, and it may here be noted that the builders have adopted the now common plan of closing over the top of the crank case beneath the cylinder with a tray through which the piston-rod and the piston cooling pipes pass, the object being to prevent the leakage of any water or used lubricating oil into the crank chamber.

It was explained in the descriptions which have been published of the Doxford and the Vickers engines that the starting air valves fitted in the cylinder covers for the admission of compressed air to start up the engine were of the non-return automatic type, and that the mechanically operated distributing valves were actuated from the cam shaft at some other part of the engine remote from the cylinder itself. It is a question upon which opinions do not coincide whether this is preferable to the employment of valves in the cylinder covers directly operated from the cam shaft by means of ordinary valve levers. The former system calls for two valves instead of one, but appears to simplify the gear necessary. The North British Company has adopted the older method of a directly operated valve in the cylinder head, so that in the cylinder cover there are the usual four mechanically controlled inlet, starting air, suction and exhaust valves.

The method of driving the cam shaft in a four-cycle engine calls for some comment, as it has a bearing upon the general valve mechanism. Harland and Wolff, in their design, have arranged for a direct spur wheel drive from the crank shaft, which is simple and reliable, but necessitates, or at least renders desirable, that the cam shaft should not be arranged too far above the crank shaft. The result is, in that engine, that long vertical push rods operated from a cam shaft about half-way up the engine are employed. In the North British type the cam shaft is arranged not far below the top of the cylinders, which necessitates a drive through a vertical shaft with bevel gearing top and bottom. The actual drive from the crank shaft is taken from a two-to-one spur gear, so that both the vertical shaft and the cam shaft rotate at half engine speed. The valve levers are not operated direct from the cams, but through the intermediary of short push rods with the usual rollers at the bottom; in the case of the push rods for actuating the air starting valves the roller is put in contact with its cam through the intermediary of a piston working in a small compressed air cylinder at the bottom of the push rods, compressed air being

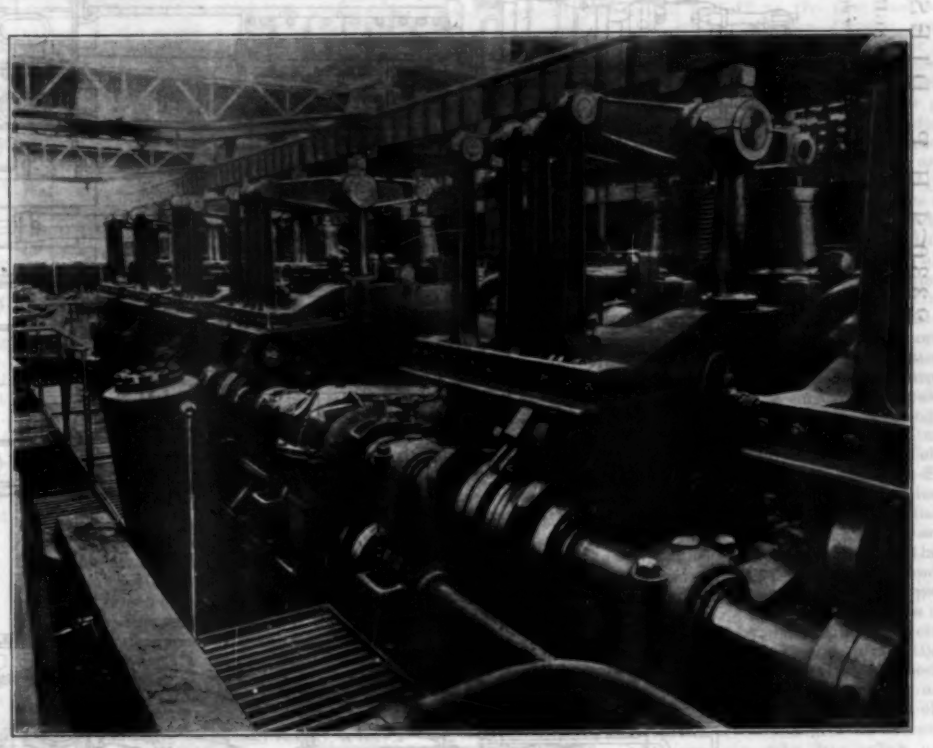


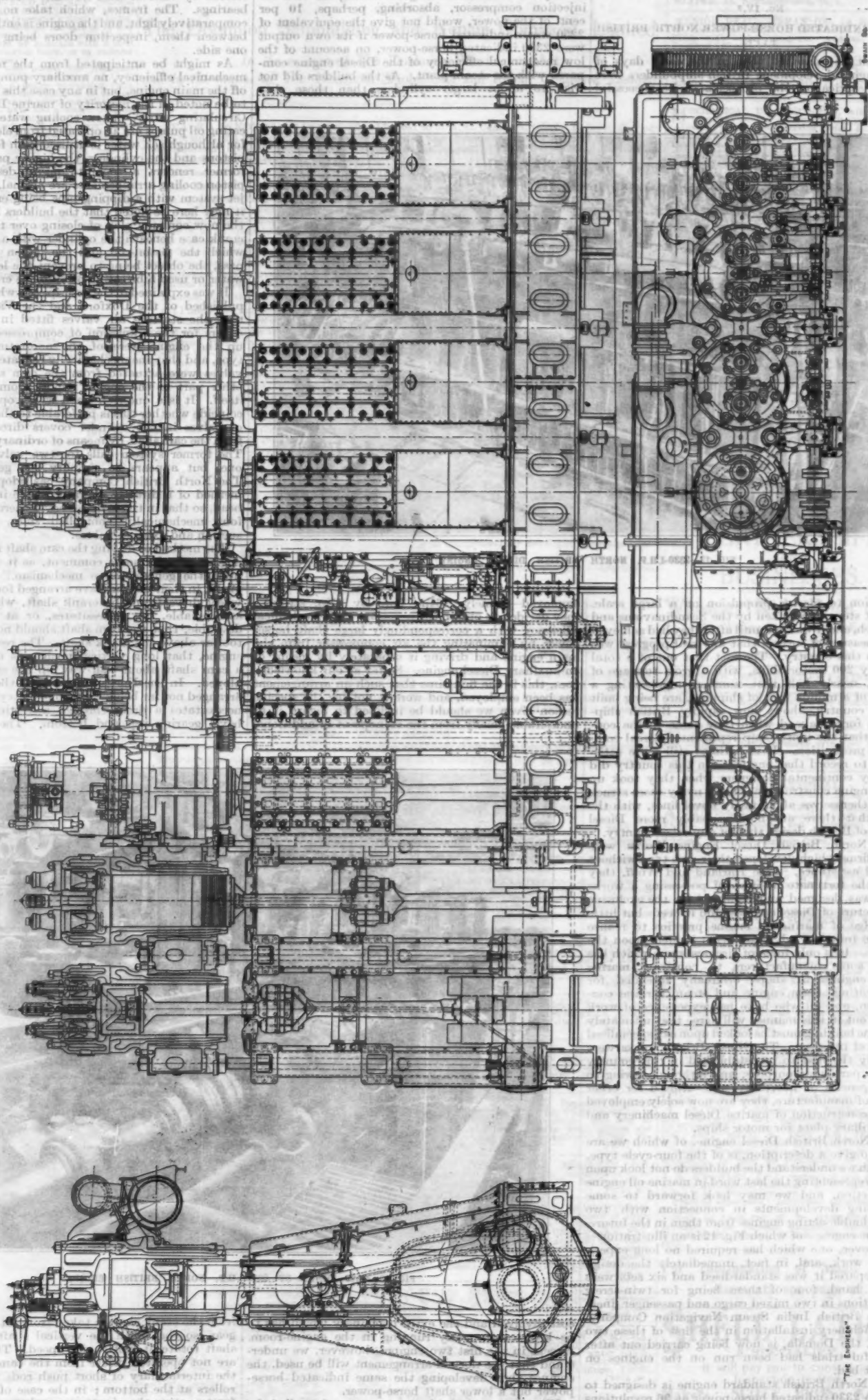
FIG. 13—CAM SHAFT OF 2330-I.H.P. NORTH BRITISH ENGINE

* No. III. appeared July 15th.

2330-I.H.P. DIESEL MARINE ENGINE

THE NORTH BRITISH DIESEL ENGINE WORKS, LIMITED, WHITEINCH, ENGINEERS

(For description see page 109.)



THE ENGINEER

admitted by the movement of the starting lever at the control station.

Side by side astern and ahead cams are fitted on the cam shaft to give the required direction of rotation, and the usual principle of moving the cam-shaft lengthwise when reversing is adopted, as with many other types. The designers have, however, worked out the details in a novel manner, the cam shaft being allowed to fall bodily in order that it may be moved fore and aft without fouling the rollers at the bottom of the push rods.

Referring to Fig. 13, which gives a near view of the cam shaft, it will be noted that there is a horizontal lay shaft immediately below the cam shaft. On this lay shaft is an excentric below each cam shaft bearing, and there is, moreover, a scroll seen near the centre, which gives a longitudinal motion to a lever rigidly attached to the cam shaft, and thus moves the cam shaft. When the lay shaft is moved, therefore, by the operation of a lever from the control station—Fig. 15, p. 120—the excentrics supporting the cam shaft bearings rotate with it and cause the cam shaft to fall well below the push rod rollers. During this period the scroll has no action, but with the further rotation of the lay shaft the cam shaft remains at its lower level and the rotation of the scroll causes it to move in a longitudinal direction. This movement is sufficient to bring the astern cams under the push rods, and the final portion of the rotation of the lay shaft—making 360 deg. in all—causes the cam shaft to be lifted on the excentrics until it is in its normal running position.

The method of control of the engine may be explained in reference to Fig. 15. Below the two main levers, which are for starting and speed variation, will be seen the reversing lever. When this is moved to its astern position it brings into operation a servo motor, the air cylinder of which can just be seen. Through a rack and pinion gear this causes the complete rotation of the lay shaft, thus giving the cam shaft its right setting for running in the astern direction. The two starting levers above are then moved to the bottom of the quadrant in which they work, the effect of which is to open the main air starting valves, and to admit air to the small cylinders, bringing down on to their cams the rollers at the bottom of the push rods actuating the starting air valves in the cylinders. Compressed air is thus admitted to one or more of the working cylinders, causing the engine to start and run on compressed air so long as the starting levers are in their bottom position. It should be added that each of these levers control one group of four cylinders, and the next movement is to raise one of the levers through about half its range in its quadrant. This shuts off starting air from the one cylinder group and brings the fuel pumps into operation so that four of the eight cylinders continue to run on fuel instead of air. Finally, the second starting lever is moved up to a corresponding position putting all eight cylinders on oil, and the engine is speeded up as required by a further movement of the two levers which open or close the suction valves of the fuel pumps, thus allowing a smaller or greater amount of fuel to reach the fuel valves in the cylinder covers. There are eight of these pumps, one for each cylinder, and they are grouped together in the centre of the engine at the level of the intermediate grating, being driven from the vertical shaft from which the cam shaft derives its motion.

Fig. 16 is a view between the two engines of the motor passenger ship Domala, as erected in the makers' works, whilst Fig. 17 shows the tops of the two sets. Fig. 14, p. 110, is a sectional drawing of one of the engines.

We were favourably impressed with the running of the engine at the time of our visit to the works, and it need hardly be said that special interest will attach to its operation in service in view of the fact that it is one of two engines intended for the propulsion of a passenger liner. The innovations that have been introduced need hardly be termed experimental, and there is therefore apparently no reason why equally good results should not be achieved with the North British engine as have already been attained with other Diesel motors.

Training of Apprentices on the Victorian Railways.

RECOGNISING the advantage of having well-trained artisans in the railway service, definite regulations have, as the outcome of many years' study of the question, been laid down by the Victorian Railways Commissioners for the entrance and training of youths who enter the service of the State's railways as apprentices. Under these regulations it is possible to obtain a very good class of youths who, after a training in technical and practical work, are well prepared to become first-class tradesmen, and eventually foremen. In some cases, when the ability of an apprentice is outstanding, he may become a member of the professional staff, and in course of time may be appointed the head of his branch, as has occurred quite recently, when one, who joined the service as an apprentice fifteen years ago, was appointed the chief electrical engineer of the Victorian Railways. The number of applications for admission as apprentice is always greatly in excess of the number required; in one case there were 375 applicants for six vacancies. In order that every candidate may receive impartial treatment, certain rules are made, which are described later.

At the commencement of each year notices are posted up in prominent places, and printed particulars of the vacancies are forwarded to all the technical and high schools in the State, inviting applications from youths who desire to become apprentices to the following trades:—Blacksmith, boilermaker, brass moulder, car and wagon builder, car painter, coppersmith, electrical fitter, electrical mechanic, fitter and turner, iron machinist, lampmaker, pattern-maker, sailmaker, spring maker, upholsterer, and wood machinist. Opposite each trade is put the number of vacancies available owing to the exigencies of the department. The total number of vacancies varies, but it is generally slightly over 100. The age of each candidate must be fourteen years or over, but less than eighteen years, and he must serve a term of five years. Application forms are obtained from the Secretary for Railways, and they are returnable by a certain date. The candidate must fill in the form in his own handwriting, and specify the trade he wishes to follow. Any person who has been dismissed from the railway department, or whose employment has been terminated for cause, or who has been convicted of a felony or misdemeanour, is not eligible for employment.

On the date closing the receipt of application forms, as each form is opened the candidate's name is entered into a register book and a consecutive number is placed opposite, and from that time until the selection is completed the candidate is referred to by his number.

When the number of candidates is more than twice the number to be employed in any grade, a board of selectors, consisting of three departmental officers, is appointed to interview each candidate as to his fitness and general capability. This board visits the different centres in the State, and each candidate is presented with a card, bearing the number recorded against his name in the register, before interviewing the members of the board, who should not be informed of the names of the applicants. Any applicant disclosing his name is disqualified. After all the candidates are interviewed the board of selectors reduces the number of applicants to a number not exceeding twice the number to be employed. The candidates remaining are then examined by the Railways Medical Officer. They must be free from any physical infirmity, and up to the prescribed standard for vision, colour sense, and hearing. An educational examination must then be passed. It consists of questions in arithmetic, geography, grammar, reading, spelling and writing, and it is equivalent to the seventh grade standard in the State schools.

The successful candidates in any grade, if not in excess of the number required in such grade, are then called together in order that a ballot may be taken for precedence of appointment, as, when all things are equal, seniority is the deciding factor. If the number of successful candidates in any grade is in excess of the number required in such grade, they also ballot for precedence of appointment. The drawing is made in the presence of the Secretary for Railways, and two boxes, numbered 1 and 2 respectively, are provided. Numbers corresponding to the total number of successful candidates are placed in each box, and the number drawn from No. 1 box determines the order which a candidate shall draw from No. 2 box, and the number drawn from the latter decides his relative seniority for future promotion, &c. The remaining candidates who, by this method have been unsuccessful in obtaining immediate appointment, are, in the order so decided, eligible for appointment during the next twelve months without further or other examination.

The daily rates of pay are the same for all apprentices, being:—First year, 3s.; second year, 3s. 9d.; third year, 5s. 3d.; fourth year, 6s. 9d.; fifth and last year, 9s. These are the rates paid to apprentices who come under the railways classification of wages, &c.; but certain trades come under a wages board determination, which is an independent tribunal for each trade, the Government having no representative on the board. In the case of an apprentice whose trade comes under this category, he will receive the wages board rate if more favourable for any particular year of training. As in some cases it will be necessary for the apprentice to live away from home when he is in receipt of a wage of 6s. 6d. a day or less, the department grants a daily allowance for six days a week equivalent to the difference between his daily wage and 6s. 6d. a day.

The apprentice must serve six months on probation, after which period, provided his conduct, capacity and industry have been satisfactory, he is appointed to the permanent staff. Before, however, the appointment is confirmed he must insure his life with a life assurance company in accordance with the regulations of the department. As pensions are not granted by the Victorian Government, each officer and employee must insure his life for prescribed sums, or take out additional policies before an appointment or promotion can be confirmed by the Commissioners.

The majority of the apprentices obtain their practical training at the locomotive, carriage and wagon workshops, Newport; but some are trained at the locomotive works at Ballarat and Bendigo, the signal shops, Newport, the way and works branch workshops, North Melbourne, and the electric car sheds, Jolimont. In all cases they obtain a thorough training in their respective trades until such time as their apprenticeship is ended, when they are appointed journeymen.

As soon as an apprentice is appointed he must attend either the Melbourne Technical School—generally termed the Working Men's College—the Ballarat School of Mines, or the Bendigo School of Mines, as may be determined by the Railway Commissioners. He must attend classes as enumerated below for a period of three years at such hours of the day and night as are prescribed during the complete course of training. Facilities are given him to attend these classes, and he must present himself for such examinations as are prescribed. All fees are paid by the department, but the apprentice must provide his own books, drawing instruments, &c.

In the first year all apprentices must attend classes in elementary science, arithmetic, and mensuration, projection, mathematics and geometrical development. In the second year classes must be attended in mathematics, engineering drawing, and applied mechanics; except lampmakers, who take freehand drawing and sheet metal work in place of applied mechanics; woodworking machinists, who take freehand drawing in addition; nickel platers, who take electricity in place of applied mechanics; and painters, sailmakers and trimmers, who take geometrical and freehand drawing in place of engineering drawing and applied mechanics.

In the third year trade teaching takes a prominent part. Boilermakers, coppersmiths, spring makers, fitters and turners, &c., take mechanics and steam, electricity, engineering drawing, algebra, and solid geometry; painters take freehand drawing, design and decorating; plumbers, building construction and plumbing (practical work); car builders, bricklayers and carpenters, a trade instruction, freehand or trade drawing, and solid geometry. Sailmakers and trimmers take mathematics, freehand and geometrical drawing; nickel platers, engineering drawing and chemistry (theory and practice); woodworking machinists, mechanical and freehand drawing and woodworking machine work (practical); gasfitters, mechanical drawing and gasfitting (practical); and lampmakers, mechanical and freehand drawing and sheet metal work.

Prizes are awarded annually by the Commissioners to the two apprentices who are judged first and second in order of merit in class, good conduct, regular attendance, zeal and industry, provided that they obtain not less than 75 per cent. of the possible marks. The prizes awarded in the first and second years are £5 and £3 to the first and second apprentices in order of merit, with additional prizes given in the second year of £3 and £2 to the first and second apprentices respectively, in order of merit, who are being trained for what are termed the lower grade trades, viz., carpenter, lampmaker, sailmaker, &c. In the third year prizes of £3 and £2 are awarded to the first and second apprentice in this latter grade. For the higher grade the apprentice who is adjudged first in order of merit is nominated as a student in either mechanical or electrical engineering, as may be determined by the Commissioners, and the apprentice who is adjudged second is awarded a prize of £5.

The nominated engineering student attends one of the schools previously mentioned, and takes a two years' full day course, during which time all fees are paid by the department, and he is paid an allowance of £130 a year in lieu of wages. During the first year classes are attended in applied mechanics and electricity, mathematics including trigonometry, mechanical drawing, surveying, fitting and turning, pattern making and moulding, and metallurgy for engineers. Second year classes consist of the calculus, applied mechanics (machine and structures), engineering drawing and design, applied electricity, milling and gear cutting, a short course on practical electric wiring, and pattern making and moulding. Should this apprentice pass the prescribed examination and obtain a diploma, he is employed as an engineering assistant with a commencing salary of £225 per annum.

In the case of an apprentice not passing either the first or second year course he is allowed a second year in which to qualify in such course, but must pay the required fees himself, and attend such classes in the evening, no time being allowed off under these circumstances. Any apprentice who fails to pass either the first or second year course after having studied such course for two years, or who is adjudged as not taking full advantage of the classes by acts of misconduct or absence from classes is liable to be instantly dismissed. An apprentice who has taken a high place in his final examination is eligible at any time to be employed in a drawing-office, serving a probation as an acting draughtsman for six months. If his service is found satisfactory in that capacity the appointment as draughtsman is confirmed.

A little social function is always arranged by the apprentices who have completed their three years' technical course, to which all third year apprentices, technical instructors and certain railway officials are invited. The chair is taken by one of the last, and suitable advice as to the desirability of further pursuing their technical studies is given to the apprentices by the chairman and others.

Grinding Gear Wheel Teeth.

THE employment of hardened spur gear wheels for high speeds and heavy loads has undoubtedly been greatly hampered by the fact that however accurately the teeth may be cut in the soft metal, the subsequent hardening process destroys the accuracy by reason of the distortion which it produces. Realising this fact, many people have turned their attention to the grinding of hardened gearing, but the efforts made in this direction have not been invariably successful, the chief reason being the difficulty of compensating for the wear of the grinding wheel.

In our issue of March 18th we described the Maag gear-grinding machine. This machine, it may be recalled, works on the generating principle, after the manner of the "Sunderland," the Maag and other gear-cutting machines, with the substitution of a pair of thin saucer-shaped grinding wheels for the straight-sided rack cutter. True involute profiles are thus ground on the teeth after hardening. The lips of the saucers are plane to begin with, and reliance is placed upon their remaining plane after wear has taken place. Such wear merely tends to increase the width of the tooth, and is compensated for by means of a pair of diamond-pointed "feelers," bearing against the lips of the grinding wheels. When a certain very small amount of wear has taken place the movement of the "feelers," in following the receding lip, automatically closes a switch in an electric circuit, with the result that the wheels are moved axially by an electric motor to the extent required to compensate for the wear. The Maag machine can, we think, be accepted without dispute as a satisfactory and practical appliance for correcting the distortion of spur gearing produced by hardening.

It is obvious that if the final accuracy of a hardened gear wheel is given to it in a grinding machine, it is uneconomical to cut it in the first instance with a greater accuracy than is required to ensure that the teeth will clean up after the distortion caused by hardening has occurred. As the amount of this distortion cannot be exactly foretold, it follows that the machining allowance to be left on the teeth may have to be relatively considerable, more, in fact, than a grinding machine designed delicately to "correct" the teeth should reasonably be called upon to undertake. The ideal grinding process should thus consist of a roughing cut followed by a final trim to the exact size and form. It further stands to reason that the two stages of the operation should be carried out at one setting of the work, and therefore in the one machine and with the one grinding wheel. How far the Maag machine is capable of taking a roughing and a finishing cut we are not quite certain, but it seems probable that its design makes it more suitable for finishing than for roughing the teeth. It at least differs considerably in this respect from another gear-grinding machine that we have recently inspected, an American invention which, during the past ten years or so, has been gradually developed and brought to a practical success by the Gear Grinding Company, Limited, of Anne-road, Handsworth, Birmingham. This company, it should be explained, does not make the machines for sale, but confines its attention to grinding on them the spur gear wheels which it receives machined and hardened from its customers, largely motor car manufacturers. The customers machine the wheels to specified allowances, harden them and grind them in the bore and elsewhere as required. The grinding of the tooth profiles to a stated standard of accuracy is the specialist work of the Gear Grinding Company.

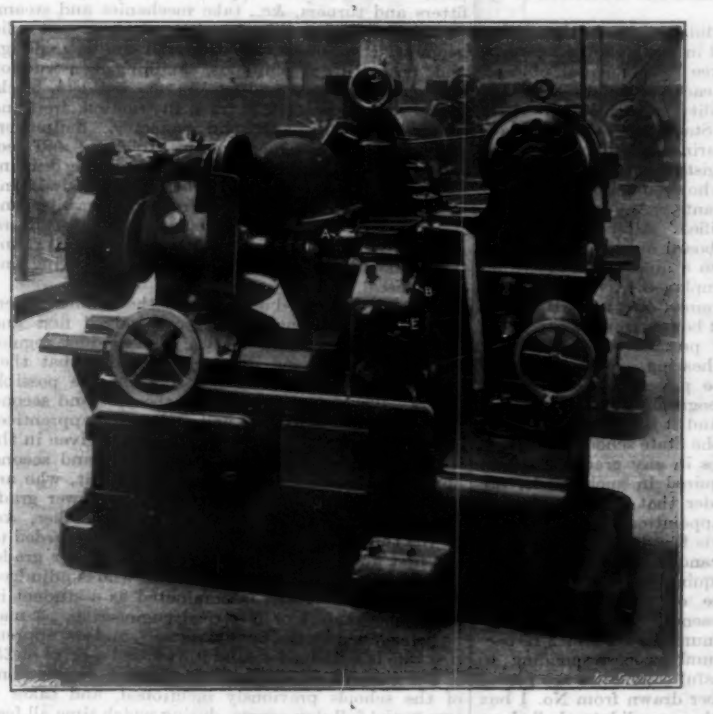
The allowances left by the customer on the gear wheels are relatively considerable. Thus the diameter at the bottom of the tooth gaps in the case of the small wheels of motor car gear boxes can be .01 in excess of the nominal dimension. On each flank of each tooth the material left should be between .006in. and .009in. over the correct final size. On larger wheels greater allowances are made. The tooth profile is not limited to any one form, and the pressure angle is open to unrestricted choice. The requirements are therefore such that the wheels may be formed roughly in milling machines, and do not essentially entail the use of generating or other special forms of gear-cutting machines. The grinding of the bore, however, has to be carried out to fairly fine limits, for any great variation or inaccuracy in this diameter would affect the work subsequently done on the wheels by the Gear Grinding Company, and the behaviour of the wheels when subsequently put into use. In addition, the end faces of the wheels have to be ground dead true with the hole in order that they may not tip when clamped in the company's grinding machines or when assembled in the finished gear-box or other component. Granted the wheels are supplied to it with these conditions fulfilled, the company is prepared to guarantee that it will finish the tooth profiles to the required degree of accuracy without producing scrap.

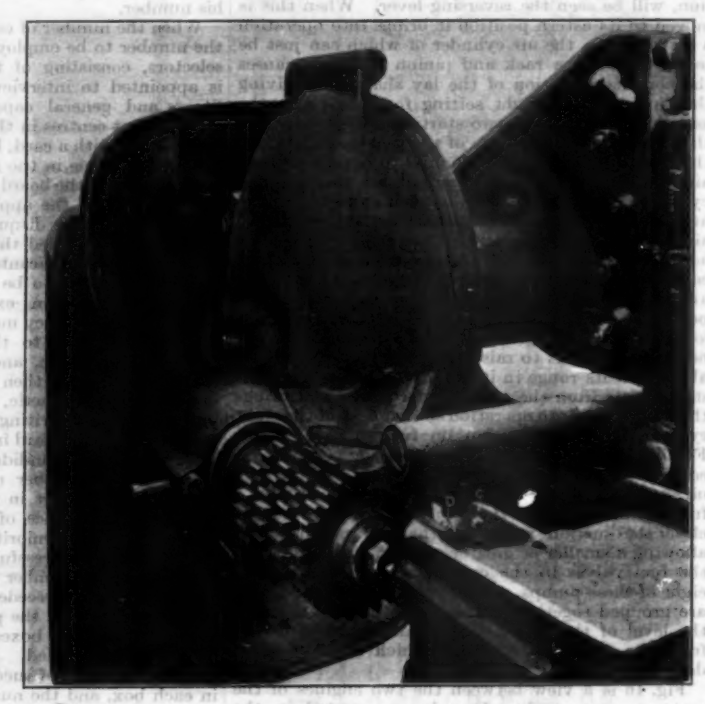
It will be seen that the operation undertaken by the company is not a mere correction of very correctly formed teeth distorted by the hardening process, but that it involves the removal of a fair amount of stock from the flanks and the root diameter of relatively roughly formed wheels. In these circumstances it is not surprising to find that the company's machines do not make use of the generating principle. At the same time it is a little surprising to learn that with the alternative process adopted, the employment of a shaped grinding wheel, the accuracy obtained is claimed to exceed that produced by a generating process. Yet on investigating the method of working of the machines, the claim made in this respect does not appear to be unjustified.

The general principle of working consists of providing in each machine means for bringing the edges of the grinding wheel to the correct profile for the particular job in hand, and for subsequently re-trimming the edges to the original shape at any time when the wear of the grinding wheel has become sufficient to make such re-trimming necessary. In practice the grinding wheel is formed to the correct shape to begin with, and is in general not re-trimmed until after the rough grinding of the gear wheel has been accomplished. The re-trimming is, of course, effected without removing the work from the machine or the grinding wheel from its shaft.

The trimming means consist of three diamonds, one mounted to traverse across that portion of the grinding wheel edge that cuts on the diameter at the bottom of the teeth, and two mounted to trim the concave flank edges of the grinding wheel to the required involute form. The level at which the diamonds are mounted—more precisely the level of the diamond first-named above—is the datum line of the machine. The grinding wheel spindle lies above this level and the work arbor below it. As the grinding wheel wears its edge tends to recede upwards away from the datum line. On re-trimming, it is fed downwards on to the diamonds so as to recover its original level. The feed of the work is upwards towards the datum line. Thus, after re-trimming, the grinding wheel edges have exactly the same profile as at the beginning—except for any wear that may take place on the diamonds—and are at the same level relatively to the shop floor, the only difference being that the grinding wheel is of slightly reduced diameter. The work is performed by traversing the grinding wheel between the teeth of the gear wheel, which is held stationary during each such traverse, and is indexed round one pitch distance after the grinding wheel has withdrawn. When one complete turn of the gear wheel has been executed, upward feed is applied to the slide carrying the work arbor, and traversing, indexing and feeding are resumed and continued until the finished dimensions are reached.

It will thus be seen that the wear of the grinding wheel, in so far as it reduces the diameter, is compensated for by feeding the grinding wheel on to a trimming diamond which remains always at a constant level, or, to be quite exact, which, during the trimming process, moves in the arc of a small circle the centre of which is a fixed point on the machine. This diamond—A, Fig. 1—is swung backwards and forwards across the edge of the grinding wheel by means of the handle B, and is so moved until it ceases to cut the wheel. The wear of the grinding wheel, in so far as it alters the concave cycloidal faces, is corrected by means of the two diamonds C, D, Fig. 2. These diamonds are moved by power—a slow and a fast speed are provided—and are given the correct cycloidal motion by means of cam mechanism in the box E, Fig. 1.





FIGS. 1 AND 2—MACHINE FOR GRINDING GEAR WHEEL TEETH

Much obviously turns upon the accuracy with which the cams in the box E are cut. We were not permitted to inspect the process, and can only say that the work is begun by making an aluminium templet eighteen times the full size of one profile. From this templet two identical cams are copied on a scale of six times the full size of the finished tooth profile, and after completion are fixed in the box E. Separate templets and cams are required for each different pitch and wheel diameter. In addition the system of testing the finished gear wheels adopted by the company calls for the provision of special jigs and fixtures for each different job. It follows, therefore, that the greater the number of similar gear wheels there is to grind the more efficient commercially is the process.

The company so far has not attempted to grind gear wheels other than those of the straight spur type. It has, however, recently applied its process to the finish grinding of the splined or castellated shafts on which the gear wheels of motor car gear-boxes are commonly mounted. It is obvious in this connection that it is practically a waste of time and money to finish the teeth of the wheels with great accuracy if at least equal accuracy cannot be assured in the shafts on which they are to be mounted. The holes in the bosses of the gear wheels are bored, broached and, after hardening, ground in an internal

grinding machine by the customer. To assist in attaining the necessary accuracy in the spline slots the Gear Grinding Company undertakes the finishing of the customer's broaches to the required limits. The castellated shafts are turned, splined, hardened—if they are to be hardened—and ground on the top of the splines by the customer. The wheels and shafts are then sent to the Gear Grinding Company, which finishes the wheel teeth in the manner described above, and grinds the shafts on the flanks of the splines and on the cylindrical surfaces between them to fit the holes in the wheels as ground by the customer. A castellated shaft is virtually a very broad gear wheel with one or more—commonly four—straight-sided teeth, and can therefore be ground in the company's machines in the same manner as are gear wheel teeth. The cams in this case are designed to give a rectilinear motion to the two outer diamonds, while the third diamond is caused to move in a circle of radius equal to that of the shaft at the bottom of the spline ways. It should be noted that the bearing between the gear wheel and the shaft is not made on the tops of the castellations but on the cylindrical surfaces at the bottom of the ways on the shaft. The accuracy with which the wheels and shafts are finished is such that the assembly of the gear-box becomes virtually an unskilled job.

Another interesting development of the company's work consists of the finishing of large gear wheels—such as are used on railways and tramways—with soft steel centres and hardened tooth rims. The rims are cut, hardened and shrunk on to the centres, and the completed wheels are sent to the company for the finish grinding of the tooth profiles.

It will be agreed, we think, that the company's existence opens up new possibilities in the production of gearing. Its specialist work relieves the ordinary engineering factory of the necessity for possessing an elaborate gear wheel cutting plant, and enables the factory to command increased accuracy in its gear wheels at a cost which is certainly not greater and in some cases is probably less than it could produce them for itself.

Incorporated Municipal Electrical Association.

IT was the original intention to hold the annual convention of the Incorporated Municipal Electrical Association in Dundee in June, Major H. Richardson, chief electrical engineer to the Dundee Corporation, being president; but, owing to the coal strike, the meeting had to be postponed, and it was held at the Institution of Mechanical Engineers, London, on July 20th, 21st, and 22nd.

Major Richardson, in the course of his presidential address, pleaded for greater co-operation between municipal electricity supply undertakings and electricity supply companies. He said:—

"The reiterated accusations against private enterprise which insist that industries financed by private bodies make large profits and generally batten upon a helpless public are not borne out by the facts of the case as I see them. Indeed, I would go further and state that it would have been impossible to develop the electrical industry to the extent it has been developed had it not been for the risks taken and losses experienced by companies and their shareholders in the early days of electricity supply. Even to-day it is an outstanding fact that we have to rely for the necessarily expensive stages of experiment and initiative on those concerns owned by companies, and as I am making a plea for more cordial dealings between municipalities and companies, I would draw attention to what is not generally appreciated, viz., that the records for cheap electricity supply in this country are held by supply companies, and that there is no evidence to show that, generally speaking, the charges made by them are in excess of those made by municipalities. In the United States of America, where current is sold comparatively as cheaply as it is sold in this country, the supply is almost entirely in the hands of private enterprise, and a noticeable circumstance in this latter connection is that the development of the uses of electricity have been much more intense and the benefits to the public have been greater and more rapid than on this side.

"It is no use denying that under modern conditions municipalities will have to adopt a more liberal view in the methods of developing their trading departments if they are going to maintain their hold upon such a vast industry as the power supply of the immediate future must become. Unpalatable to extreme nationalisationists or municipalists as these remarks may be, yet I am so anxious to see municipalities maintain a high standard of public service of electricity, with more rapid development, that I cannot refrain from pointing out the dangers of the continued parsimony of view which have recently been apparent to such an extent as to threaten their own undoing unless boldly faced and overcome. It would be, admittedly, so easy for one to flatter local authorities both in and outside our Association with a few pleasant and congratulatory remarks regarding apparent progress, but at such a critical time as this it would be a most unfriendly and insincere thing to do."

Another feature of the address—and it was a prominent one throughout the convention—was the expression of good will towards the Electricity Commissioners and a determination to help them in their work to the fullest possible extent.

The question of multi-part tariffs, which is receiving so much attention in the electrical industry to-day, was also referred to, and it was made clear that electrical engineers generally now wish the flat rate system, under the old Electricity Acts, to disappear. The Electricity Commissioners are hampered in this and many other matters needing reform in the light of modern conditions, in that they have no legal powers to take action, much as they are known to be anxious to do so. As a matter of fact, however, permission has been given to the Maidstone Electricity Committee to increase its charges on the maximum demand system for shop premises without the compulsion to offer an alternative flat rate, although it is admitted that the legal powers of the Commissioners to do so are doubtful.

Finally, Major Richardson pleaded for a consolidation of the various electrical associations and institutions, so that there could be one large electrical convention each year dealing with all aspects of the matter, the individual bodies carrying out their own functions during the year as at present.

In addition to the presidential address on the afternoon of Wednesday, July 20th, a paper was read on "Some Financial and Business Aspects of Municipal Electric Supply," by Mr. C. W. Charlesworth, of the Wolverhampton Electricity Supply Department, which reviewed the whole position. The important matters brought out in the paper and discussion were the difficulties experienced with regard to working capital and the need for the enforcement of multi-part tariffs and the abolition of the flat rate charge. The lack of powers of the Commissioners to do many things was commented upon, and it was urged that steps should be taken to secure wider powers from Parliament.

On Thursday, July 21st, three important papers were taken. Two of them, dealing with boiler-house practice, were read in the morning and discussed together.

In the first of these papers Mr. D. Wilson discussed steam raising and its general aspects, and outlined possible developments. Testing efficiency and operating efficiency were compared in the hope of arriving at a means for overcoming the considerable difference of opinion which exists as to the maximum efficiency which can be expected for modern boiler plant. As regards test efficiency, it is claimed to be established that when using a high-grade coal a modern boiler should give on test a combined efficiency of boiler, stoker, superheater, and economiser equal to 85 per cent. of the net calorific value of the fuel. The following heat balance of a complete boiler unit working at full normal rating of 5 lb. per square foot of heating surface, with gases leaving the economiser at 370 deg. Fah. and an average CO_2 content of 12 per cent., the coal being of high-grade quality, is given as a basis and as indicating results practically achievable now.

Heat Balance.

	Per cent.
Heat absorbed by boiler and economiser	85
Heat lost in chimney gases	9
Heat lost in combustible in ash	1
Heat lost in radiation	4
Balance unaccounted for	1
	100

The chief factors affecting daily operating efficiency are set out as load factor, lack of instruments for controlling efficiency, variability of the coal used, and the human element.

As to the future, Mr. Wilson thinks boiler pressure may advance still further if the turbine contractors call for it. From the boilermaker's point of view it is difficult to forecast the limit, but for existing designs and large units it may be about 600 lb. to 650 lb., although it should be possible to design boilers for even higher pressures if desired. Boilers are being constructed in this country for 1000 lb. pressure now, but they are for process work abroad and do not include drums in the ordinary sense of the term—the most difficult section to manufacture in large sizes. They are really heating boilers and work on a closed cycle, so that the water and the scale question presents no difficulty. Superheat is not likely to advance much beyond the present maximum of 750 deg. Fah. final temperature, as that appears to be about the limiting temperature to which it is expedient to subject the steel of which the superheater is constructed. The limits of present boiler-house practice are, therefore, well within the range of our assisted vision, and the next big advance will be in the engine-room in the recovery and utilisation of the latent heat at present dissipated to heat our rivers and atmosphere. We must always feel uneasy in the thought that the best central station record in the world indicates that we are only able to utilise 18 per cent. of the available heat energy in the coal and that the expectations of the immediate future are limited to a possible 25 per cent. The modern boiler is certainly doing its part of the work efficiently, and if the average result is not up to the possible maximum, that is not the fault of the boiler.

Selection of coal is an important factor, and station engineers must bring action to bear in order to secure coal of more uniform quality and to ensure that the ash be removed at the proper place, viz., the colliery. With better coal selection, perfect supervision in the boiler-house, complete equipment of all instruments and apparati for controlling combustion, and the further possible small improvements in design we can foresee the bulk of our electricity being generated at an efficiency of 18 per cent. instead of the present miserable average of about 10 per cent., but beyond that our vision fails so far as the steam generating plant as we know it to-day is concerned. Beyond it, there was nothing on the horizon which suggests any radical departure in boiler design.

Mr. W. M. Miles, of the Sheffield Electricity Department, gave a lot of valuable information concerning the practical details of boiler management, the keeping of records, &c., and advocated some standard method of purchasing coal, taking calorific value, size of sieve for sampling, &c.

The discussion on these two papers emphasised one or two important points. Mr. W. H. Patchell referred to the large boilers now being used in the power stations at Detroit, and recalled the large boilers he put in the Bow power station of the Charing Cross, West End and City Electricity Supply Company in 1904. Now the advocates of large boilers were coming into their own. As instancing the size of boilers in American power stations, he mentioned those at the Hellgate power station of the New York Edison Company, the lower drums of which are 21ft. below the floor line, and the size of which was enormously greater than anything we had used over here. Another feature of modern boiler design was large combustion chambers.

The question of the purchase of fuel was touched on by a number of speakers. For the most part opinion favoured purchase on quality, Mr. S. E. Fedden, of Sheffield, regarding it as a crying shame that coal should be the only commodity that could not be purchased on quality. On the other hand, Mr. W. B. Woodhouse, chief engineer of the Yorkshire Electric Power Company, said the matter was worth looking into from the colliery owner's point of view. Whilst it was possible to specify a certain seam from which coal should be drawn, not much else could be done, except to specify the quantity of ash. Personally, he thought it would be found impossible to purchase on calorific value, and if coalowners were driven on the matter, they would simply put up the price. The enormous loss entailed by so much ash being transported about the country as was the case at present was prominently commented upon, and satisfaction was expressed at Sir Charles Markham having succeeded in getting his men to fill with forks again instead of shovels, a practice which was started during the war. Another suggestion was that there should be three recognised grades of coal for power station work.

Some interesting information was given as to the difficulties encountered in running power stations during the coal strike. Many of the undertakings were compelled to use all kinds of fuel: coal, coke, coke dust, outcrop coal, pit mound coal, tar, oil, &c. At Birmingham very low-grade fuel was used with the aid of oil, the burners being fixed in the front of the boilers and taking 15 gals. of oil per hour, after experiments with burners in the sides of the boilers taking 100 gals. of oil an hour had failed to give satisfactory results. The Yorkshire Power Company had such poor quality fuel on one occasion that it actually put the fires out. Similar difficulties were met with at Sheffield, where the oil at times was so thick that it would not run until treated with steam heaters. It cost the Sheffield Corporation Electricity Department from £15,000 to £20,000 more for fuel during the coal strike than it would otherwise have done, and the demand on the station fell by half. One possible line of development arising out of the emergency work during the coal strike is the use of very low-grade fuel when oil sprayed.

Pulverised fuel was criticised from the point of view of the effect upon the neighbouring district. Complaints have been made of the large deposit of fine material, and a case is reported of trouble with a farmer because his cattle could not assimilate the hay, cabbages, &c., which was covered with this deposit from a power station using pulverised fuel. It was also stated that turbo-pulverisers are being turned out at the Babcock and Wilcox works in France.

In the afternoon of Thursday, July 21st, Mr. E. Cross, chief electrical engineer at Rotherham, read a paper on "Present-day Commercial Problems in Electricity Supply." There has been installed in the Rotherham power station the largest turbo-alternator in this country, viz., a 30,000-kilowatt, but nothing was said of it in the paper for the reason that the set has only just been got running and is not yet on load. The paper dealt with very much the same problem as that confronting the Electricity Commissioners regarding the various areas throughout the country, viz., at what point it pays, in present circumstances, to build large new power stations, owing to the incidence of high capital charges and high costs of plant. It is clear that no general ruling can be laid down, and Mr. Cross does not attempt to do so. For the most part the paper consists of a series of valuable charts demonstrating the gains to be obtained under varying conditions of operation. An important question is that of placing the power station at some distance from the load in order to get the advantages of river water. The paper suggests that too much may be made of the possible advantages of this point, and certainly several speakers in the discussion, at present responsible for large industrial areas, take the view that it is uneconomical to take the power station too far away from the centre of the load, even if, to have the generating plant near the load, necessitates using cooling towers. Again, Mr. Cross had most speakers with him in the opinion that 100,000 kilowatts is sufficient plant for one station, mainly having regard to the large quantity of coal to be handled. Another point brought out was that it does not pay always to spend the capital necessary to secure the last half per cent. efficiency, having regard to cost of plant, especially in small

stations. The real value of the paper was the charts.

At the annual general meeting on Friday, July 22nd, Mr. S. T. Allen, chief electrical engineer, Wolverhampton, was elected president for the ensuing year.

A matter of some interest discussed was that of price adjustment in contracts for electrical plant. There seems a disposition not only on the part of the B.E.A.M.A., but also of some engineers, to abandon the price adjustment clause now in force and revert to fixed prices. On the other hand, there are many engineers who hold very strongly that the price adjustment clause should be continued now that there is some hope of prices falling. Against this view, the manufacturers say that there is little hope of getting any reduction of the contract price as all the material is purchased at the time the contract is entered into. The matter is not yet definitely settled, because the I.M.E.A. is endeavouring to get a penalty clause for delivery, but has not yet succeeded in doing so. Meantime, therefore, the price adjustment clause, for what it is worth, remains in force.

The Prolongation of Patents.

(From a Legal Contributor.)

A CASE recently heard by Mr. Justice Sargant will serve to remind patentees that, in common with other persons whose rights were affected by the dislocation of business during the war, they are entitled to a certain measure of statutory relief.

It is obvious that the war must have interfered very seriously with the manufacture of numerous articles forming the subject of letters patent. By the Patents and Designs Act, 1907, Sec. 17, the normal term limited for the duration of a patent is fourteen years; but by Sec. 18 of the same Act a patentee may lodge a petition for an extension. In considering the matter, the court must "have regard to the nature and merits of the invention in relation to the public, to the profits made by the patentee as such, and to all the circumstances of the case." The same section gave power to the Court to extend the term of the patent for a further term not exceeding seven or in exceptional cases fourteen years. It also provided that a new patent might be granted on special conditions. The same Act provides (by 7 [2]) that the term of extension shall be five, or, in exceptional cases, ten years instead of the seven or fourteen mentioned in the former Act.

In the case of Dixon's Patent and Baxter's Patent (38 R.P.C. 23), which was heard last year, Mr. Justice Sargant was asked to exercise the new jurisdiction. It appeared that in 1904 letters patent for "Improvements in and connected with Electric Capstans" were granted to one Dixon, and letters patent for "Improvements in and connected with Capstans" were granted to certain persons who had pooled their interests in the patents. The patents expired in 1918. In 1920 joint applications were made by originating summons under Sec. 18, Sub-section 6, of the Patents and Designs Act, 1907 (as that section was amended by the Patents and Designs Act, 1919), for extension of the terms of the patents. Evidence was adduced that prior to the war there had been a growing demand for capstans manufactured under the patents; that from 1905 till March, 1915, 183 capstans had been manufactured; that from March, 1915, till March, 1917, eight capstans had been manufactured; that from March, 1917, till March, 1918, no capstans had been manufactured; and that capstans were again in course of manufacture. In these circumstances it was held that an extension of four years should be granted.

It is important to notice that the Act of 1907 specially provides, by Sec. 18 (1), that the petition must be presented at least six months before the time limited for the expiration of the patent. By the Act of 1919, however, the Court may, in its discretion, extend such period within which such a petition may be presented. It has always been the practice that an application shall be made in all cases shortly before the end of the term. The effect of the Act of 1919 on this rule was considered in In *re* Davidson's Patents (1921), 1 ch. 69. In that case the patentee who claimed to have suffered loss or damage by reason of hostilities, applied for the extension of the terms of eight several patents granted in the years 1911 to 1915 inclusive. The G.L.B. Syndicate, Limited, made a similar application in respect of three patents granted in the years, 1912, 1915 and 1916 respectively. It was held by Mr. Justice Sargant that the well-settled practice as to applications for the extension of the terms of letters patent existing prior to the passing of the Patents and Designs Act, 1919—namely, that the application had to be made very shortly before the six months prior to the expiration of the patent—had not been materially altered by Sec. 7 of that Act; and accordingly, that an application for prolongation under that section must be made as a general rule quite a short time before the expiration of the patent. He also held that the "loss or damage" through hostilities, mentioned in Sec. 7, Sub-section 3, of the Act of 1919, referred to loss or damage suffered during the whole term of the patent, and not merely to that which was suffered during a portion of that term, and that in neither of the cases was there any special circumstance to justify a departure from the general rule, and that the summonses must therefore stand over generally with liberty to restore at a later date.

The reason why the Court will decline to hear an application until the patent has nearly expired was thus explained by the learned judge: "There may be cases in which the Court will, in the exercise of its discretion, have regard solely to the loss and damage suffered by the patentee. On the other hand, there may well be other cases where the remuneration of the patentee has been altogether excessive or the patentee has been quite inert, or the prolongation might be likely to be injurious to the industry of the country, or where there are other circumstances markedly unfavourable to an extension, and in such cases the Court might not be justified for the purpose of its decision in considering solely the loss or damage suffered by the patentee." The result of this decision is that there can be no immediate relief to any patentee who may have suffered as a result of the war, unless his patent is nearly expiring.

In a case decided recently, however, it was shown that the Court has and will exercise power to give relief. We refer to In *re* Petersen's Patent (reported in *The Times*, June 9th). There a patent granted to Sir William Petersen in 1905 for improvements in navigable vessels had expired in January, 1919, and under the law before the Patents and Designs Act, 1919 (passed on December 23rd, 1919), it could not have been prolonged.

The invention related to navigable vessels of all kinds, its essential features being the peculiar curvature of the sides of the ship, and also, when the invention was carried out in its entirety, the introduction of a superstructure. The petitioners pointed out the difficulties in advantageously working a patent of this kind, including the stoppage of most shipbuilding during the war.

Mr. Justice Sargant, in giving judgment, observed that it had been held that the Act of 1919 enabled the Court to prolong the life of the invention, although the patent in respect of it had expired. Under the old law he would not have prolonged the patent, as the company had definitely decided not to apply for prolongation; but there appeared to have been loss owing to hostilities, and, if there had been no war there would probably have been a greater use of the patent. About four and a-half years had been cut out of the life of the patent, and the invention must be protected for a further period of four and a-half years from the date of the expiration of the patent, but subject to the conditions imposed in In *re* Hope's Patent (38 R.P.C. 152), the patentee undertaking to grant licences on the same terms as those imposed before the war, and no proceedings being taken in respect of orders given for building corrugated ships, or ships being commenced to be built after the expiration of the patent before its renewal.

The important points to notice about this case are (1) that relief was granted, although the term of the patent had expired; and (2) the interests of persons who had acted on the assumption that the patent had expired and would not be revived were duly protected.

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

LOCOMOTIVE WORKING.

SIR,—I have read your remarks with reference to the cut-off for locomotives with considerable interest, but, personally, I see no justification for your conclusions that an early cut-off is essentially better or that many locomotives are inefficiently handled, for that is, as I read it, the gist of your editorial.

I have not had, as has Mr. Poultney—who appears to be stepping into Mr. Rous-Martin's shoes as a dilettante locomotive writer—the advantage of riding on the engines of many different railway companies; but I have—which is perhaps better—ridden over 35,000 miles on different engines, and with many different drivers, of one company—the Midland Railway—mostly in company with indicators and other special testing apparatus, and have also ridden a few hundred miles on the engines working the Calais-Paris boat expresses of the Nord.

My experience has been that the average express passenger engine driver is a highly intelligent man, with an intimate knowledge of his engine that is beyond theory; that he can tell very accurately when he is working his engine to the best advantage; and that any interference with the working usually leads, if not to lost time, then to increased coal consumption and heavier wear on the machine. As one slight example of how a driver knows his engine, one day, when I was on the footplate of one of the three-cylinder compounds working a passenger express from St. Pancras to Leicester, there was suddenly a weird alteration in the "beat" and the "feel" just about Mill Hill. The driver shut off steam and put on the brakes gently—not at all in a hurry—and then said "Left-hand forward excentric broken." When we came to rest and investigated, it was so, the excentric strap having broken on the side he said, and we picked up bits of it for half a mile back on our return, after having sent on the train with an engine annexed from a passing goods train, which train we had shunted into the nearest siding to wait till another engine could be sent along for it. Besides the general running, it is when trouble occurs that one appreciates the driver. I have not been in many troubles—very few men have—but I have had that broken excentric strap, several burnt-out big ends—had a hole burnt in my neck with the flying melted white metal—several burnt-out driving boxes, ditto bogies, broken injector feed pipe, jammed regulator, and so on, and at such times the rapid and accurate diagnosis of the trouble by the driver is sometimes surprising.

A locomotive is a very special engine and does not work under even reasonably constant conditions, neither as regards speed, power, nor torque, nor is there any general relation between any of these main items. A locomotive is a fairly high-powered engine of 1000 to 1500 horse-power, working with steam at about 200 lb. per square inch, and, which is important, running at high piston speeds, the average for passenger working being 800ft. to 900ft. per minute, while 1200ft. or even 1500ft. per minute is regularly attained, and this with a stroke of 26in. only. Deductions based on technical tests of small stationary engines—and there are very few series of tests of high-power machines available—of comparatively low power, speed and pressure, are quite useless. Where have tests been made on the same stationary engine at powers from 100 to 1500 horse-power and piston speeds from 100ft. to 1400ft. per minute? It is only with such that any proper comparison could be made.

As pointed out by "H. H.," it is almost impossible to tell the cut-off point on a locomotive indicator diagram. I have handled over 2000 diagrams taken on the road under regular working conditions, and have often tried to locate the cut-off point, but have been unable to do so directly. The only way I have found is to draw a temperature-entropy diagram from the indicator diagram when the cut-off point—if we may call it such—shows more definitely, and can usually be located within, say, 5 per cent.

The position of the reverse lever gives a very poor idea of the cut-off, as a rule, even if the full and mid-gear values are known, for the relation is far from linear, and the angle of the regulator handle is seldom proportional to the area of opening, so that unless one has accurate diagrams correlating these factors little information can be obtained from a mere observation, while with the usual regulator a certain handle position does not even correspond to a definite opening, the latter depending on whether the handle was moved backward or forward to its position. Many regulators have also quite a considerable movement in some positions without alteration of opening area.

The relation between cut-off and regulator opening to suit varying conditions of working is "sensed" by an experienced driver, who "feels" when the engine is running "sweetly," and really it does not take so very much experience to get pretty near to the best results. The first time I handled the regulator of a passenger train I asked the driver as to how far to link up after getting going, and he told me "till the beat changes," and it is sometimes astonishing to note the difference both to "sound" and "feel" made by a single turn of the reversing handle. It is much like handling the "spark" on an automobile. The working conditions with a locomotive are so variable that no definite rules can be laid down, while engines, even of the same class, vary greatly. When, say, ten engines are made at the same time from the same drawings and patterns, &c., one will weigh perhaps a ton more than another; one will soon be picked out as a "beauty," one as a "brute," and the others perhaps "Oh, all right," &c.; but it seems impossible to find out where the difference really is, being, doubtless, due to a great number of small items, which usually balance up so as to give an ordinary result, but occasionally are mostly all of the same sign, giving in one case an exceptionally good engine and in the other case an unusually bad one.

I do not think that cut-off variations can account for anything like the 15 per cent. difference in steam—or coal—consumption mentioned by you—that is, such variations as are used in regular working by first-class drivers—for coal is regularly weighed or measured on to the tenders, and every driver knows how much he and the other drivers on similar work are using. If one man regularly used 10 or 15 per cent. more than another on the same work and with the same class of engine, he would soon hear of it, unofficially and perhaps officially. I have tested coal consumptions with many drivers and not found much difference with first-class men on the same work, and I have usually found an engine to run "sweeter" and, if anything, with a slightly lower coal consumption, with a certain amount of regulator control than with a "full-regulator" type of driver. At high speeds an engine will generally run freer and more easily with the links dropped and the steam throttled at the regulator than it will with a full regulator and a very short cut-off. It must be remembered that the back pressure and compression are increased both by linking up and by increase of speed, and at high speeds it is necessary to drop the links in order to prevent excessive back pressure; 30 per cent. cut-off is all right for heavy working at 40 or 50 miles per hour, but for 75 miles per hour a later cut-off with throttled steam gives much nicer working, and the "feel" of the engine is quite different. For a given power at a given—high—speed it will be found that the shorter the cut-off the greater will be the back pressure, so that the exhaust steam carries more energy away with it than when the cut-off is later. It is sometimes well to remember that, within quite wide limits, the energy taken out of a pound of steam depends more on the difference between its initial and final conditions than on anything else or on the difference between the steam in the boiler and that exhausted. The higher exhaust pressure with early cut-off counterbalances the gain that might perhaps otherwise be expected—though even this is doubtful—over later cut-off with throttling. If the boiler pressure goes down through a bit of bad coal or other reason most drivers will throttle at the regulator to help to get it back again, which is usually far more effective for the purpose than is notching-up.

"H. H." refers to the steam chest pressure, and in this connection the following figures may be of interest for boiler pressure, drop of pressure to steam chest, and superheat. The figures are, in each case, the averages from data taken in connection with over 400 indicator diagrams on the road under regular working conditions and without interference with the driver in probably about 90 per cent. of the cases. They were often taken every two miles on a hundred-mile run, so as to obtain horse-power curves for the journey, and thus may be considered fairly representative of average working. The boiler pressure was nominally 200 lb. per square inch and the normal temperature of the steam was supposed to be 600 deg. Fah.

Boiler Pressure.

	Per cent. of cases.
5 lb. over pressure	.9
Nominal pressure	16.9
5 lb. under pressure	29.9
10 lb. under pressure	27.1
15 lb. under pressure	17.9
20 lb. under pressure	4.9
25 lb. under pressure	1.9
30 lb. or more under pressure	.5

Drop of Pressure from Boiler to Steam Chest.

Pounds per square inch.	Per cent.	Pounds per square inch.	Per cent.
0	4.0	35	8.0
5	11.5	40	3.3
10	15.9	45	.3
15	15.9	50	.8
20	15.2	55	.2
25	12.7	60	.5
30	11.7		

Steam Temperature.

Deg. Fah.	Per cent.	Deg. Fah.	Per cent.	Deg. Fah.	Per cent.
620	.7	540	4.5	460	.2
610	4.4	530	5.4	450	.9
600	9.5	520	3.0	440	.4
590	13.8	510	2.4	430	.0
580	15.1	500	2.4	420	.2
570	12.1	490	.6	410	.4
560	12.1	480	.4		
550	10.2	470	1.3		

Mean boiler pressure 8.45 lb. per square inch below nominal. Mean drop of pressure from boiler to steam chest 17 lb. per square inch. Mean steam temperature 563 deg. Fah.

It will be noticed that with safety valves set at 200 lb. per square inch the average pressure in the steam chest was nearly 185 lb. per square inch, though it was most exceptional for the regulator to be really full open.

It is very difficult indeed to obtain accurate figures even with the best of testing apparatus, as the working conditions are so exceedingly variable, and ordinary observations, unless by a very experienced man, fully acquainted with the road and the particular engine working, are, although of some interest, of no technical value at all.

P. H. PARR.

Rock Ferry, Cheshire, July 23rd.

A Seven-Day Journal.

Industrial Situation in Barcelona.

THE revolutionary spirit which has been present in Barcelona and Cataluña generally during the past year has become much more acute to-day, and is having a disastrous effect on the industrial situation. News which is just to hand indicates that a great majority of the factories are closed, and that some of the banks and numerous other businesses have failed as a result of the continued strikes organised by the syndicalists and revolutionary element. The murder of the Prime Minister of Spain and the Governor of Barcelona was followed or accompanied by the assassination of many factory owners and works managers, and the saner elements in the population have now been enrolled to the number of about 30,000 in a National Guard. Another voluntary organisation has been formed for the defence of the factories and the protection of non-unionist workmen who were being terrorised by the syndicalists. As a result of the action of these bodies and the ruthless way in which the new civil governor has dealt with the organisation which has terrorised the majority of the workers, the situation has now enormously improved, and the impression seems to be that the revolutionary movement is being crushed. With the Latin race movements develop quickly, and perhaps the population go to greater lengths than in Anglo-Saxon countries, but in view of the similarity between the efforts of the revolutionists in Cataluña and at home, it is interesting to observe how the Government and the community have dealt with the movement in Spain.

London University Site.

ADVOCATES of the Holland Park site for the extension of London University are not relaxing their efforts. A deputation has waited on London Members of Parliament with the object of enlisting support for the selection of Holland Park rather than the Bloomsbury site. It was pointed out that whereas 35 acres of the Holland Park estate could be secured at once for less than £200,000, the cost of the 8¼ acres in Bloomsbury would be about £450,000. It is argued, too, that the site at the back of the British Museum is not large enough for the object in view, and that as an additional 15 acres could be secured at Holland Park when required, it would be possible not only to build on an adequate scale, but to provide facilities for recreation. It is understood that the London County Council is of opinion that the site question should be re-opened, and as a result of the meeting at the House of Commons it is probable that the President of the Board of Education will be again approached.

The Science Museum.

THE hope that additional accommodation would be available for the Science Museum in the new buildings which are now being constructed has not been realised, and the problem how to provide space for the numerous acquisitions which are being received has become a very difficult one. The report for last year, which has just been issued, states that the amount of available exhibition space is actually less than it was seven years ago. This condition of affairs is seriously interfering with the utility of the museum, and it has been necessary to withdraw several collections from the public galleries. A most noteworthy addition to the exhibits during the year was a Newcomen pumping engine of the year 1791, which was at work until 1915 at Pentrich Colliery, near Derby. Another engine dating from the early part of the nineteenth century has been presented by the Salt Union, but neither of the engines is yet open to public inspection. An important group of over 200 models of historical warships and other vessels has been transferred by the Admiralty from Greenwich to the Science Museum, and it need hardly be said that they form a valuable addition to the naval collection. A number of aeronautical engines used in the war by various countries has been received and important additions have been made to the collection of scientific apparatus, including some original radiometers used by the late Sir William Crookes. The workshops in the new museum building have now been fitted up, and the installation of new machine tools is practically completed. A new air compressing plant has also been installed. Efforts are being made to obtain for the library all the important works on pure and applied science which were published during the war. Colonel H. G. Lyons has succeeded Sir Francis Ogilvie as Director of the Museum, and four new assistants have been appointed.

Railways and Road Transport.

STRONG objection was taken by road and trading interests to the attempt on the part of the railway companies to obtain extended powers to engage in road transport. The opposition of those actually engaged in the business of mechanical road transport is natural, but some surprise has been expressed that trading organisations, headed by the Federation of British Industries, should be unfavourable to the competition of railway companies in the arena of road haulage. Their opinion is that if railway companies were given power to carry by road, it is hardly open to doubt that with their gigantic resources they would very soon entirely dominate the situation, and competition between rail and road would entirely cease, leaving the railways with a monopoly of road as well as rail transport. Many will be inclined to think that this is an exaggerated view to take. There is more force in the contention that if railway companies were also road carriers to any considerable extent, any breakdown or stoppage of transport arising from a strike would involve both road and rail, and be a national disaster. From this aspect of the question it seems desirable to exclude the railways from that larger share in road transport which they are now anxious to undertake. The granting of the necessary powers cannot, it has now been decided, be discussed in connection with the Railways Bill, and it is probable a special Bill will be introduced next session.

Empire Airship Routes.

ALTHOUGH the report of the Committee which was appointed to investigate the question of Empire airship policy has not been issued, it is known that it has been presented, and that it makes definite proposals and contains detailed estimates of the cost of an Imperial airship service. The Committee has taken the courageous course of not minimising the difficulties or the capital required to carry out a scheme of the kind contemplated. The report, it is understood, gives expression to the opinion that if put in operation, the services must be maintained for several years to test the traffic possibilities and the extent to which airships can maintain a service over long routes. It is suggested that a sum of £10,000,000 will be required to keep the services in operation for five or six years, and it is quite clear that such a period would be necessary to enable the compilation of reliable statistics of operation and maintenance costs. A decision whether the British and Dominion Governments are prepared to find the capital for such a scheme must be taken immediately, as, unless the date of dissolution is postponed, the airship branch of the Air Ministry will come to an end on August 1st.

Survey of Water Supplies.

SURPRISE has been expressed in some quarters that the long-continued drought has until now had no appreciable effect on water supplies, although naturally there have been official injunctions designed to prevent waste. The real effects of the want of rain will not be revealed in the shortage of water supplies, in any event, for some months to come, as the reserves created by the rains of last winter have not yet been exhausted. Advantage is, however, being taken of the present exceptional conditions to make a survey of the potable water resources of the country. This work has been assigned to the engineering inspectors of the Ministry of Health, and it is hoped it may be possible under existing conditions to place on record what may be regarded as the minimum yield from present sources of supply.

Industrial Research.

THE question of the policy to be pursued in connection with industrial fatigue research is raised in the annual report of the Chief Inspector of Factories and Workshops. Owing to the pressing need of national economy it has been necessary to curtail the activities of the Industrial Fatigue Research Board. This is a matter for regret, as what has been done has proved quite conclusively that many of our manufacturing methods are not only wasteful of human energy and therefore inefficient, but are even harmful to the human machine. A very sensible suggestion is made that in their own interest manufacturers should continue the work which has hitherto been done by the Research Board, and it is hoped that this reminder of the importance of an investigation of this character will not go unheeded.

London Electricity Supply.

IT seems clear that a somewhat serious position will arise in the London area if the Electricity Supply Bill does not become law during the present session of Parliament. A report on the subject, which was presented to the London County Council, indicated the exact position of affairs at the present time. The County of London Company may obtain the requisite authority from Parliament to proceed with its Barking scheme, which foreshadows the erection of a station designed to have an ultimate capacity of 600,000 kilowatts. When it is realized that the present generating capacity of all the London electricity undertakings is only about 500,000 kilowatts it is obvious to how great an extent the positions of the electricity supply business in London for years to come may be dominated by the Barking station. Without expressing any opinion on the technical merits of the scheme, the report draws attention to the position which now obtains, and urges that the solution of the London electricity problem on the best possible lines and unfettered by limitations could be assured by the passage through Parliament of the Electricity Supply Bill.

Ship Joiners' Strike.

A FRESH conference was held yesterday, under the auspices of the Shipbuilding Employers' Federation, with the object of effecting a settlement of the dispute of ship joiners. No official statement as to the result of the conference had been made up to the time of going to press, but great hopes were entertained that terms which might be accepted could be arranged. It is quite impossible, having regard to the urgent need of reducing manufacturing costs in the shipbuilding industry, that the special state of trade advance of 12s. per week granted to shipyard joiners in April of last year can be continued. In submitting a scheme last month for an immediate reduction of 6s., with a further reduction of 3s. on September 1st, leaving the question of the remaining 3s. to be the subject of negotiation, employers went as far as could be expected, and there was considerable disappointment when the offer was rejected. Wiser counsels may perhaps now prevail.

Irrigation in India.

REFERENCE was made at a meeting of the East India Association two days ago to the need of undertaking additional irrigation works in Sind. The river Indus, it was stated, is capable of irrigating 25,000,000 acres under proper arrangements, but some of these schemes which have been put forward were condemned. Special reference was made to the projected Sukkur barrage on the ground that it was ill-conceived, would be dangerous from the engineering standpoint, and was certain to prove a failure. Lord Lamington, who was in the chair and who spoke from experience gained while Governor of Bombay, strongly condemned this particular scheme, which would not only cost a large sum of money, estimated at from £20,000,000 to £25,000,000, but could not be profitably utilised for a long period and might even be destructive of the entire river system of the Indus.

An Appointment and a Retirement.

BY the withdrawal of Colonel Saxton White from the management of the shipbuilding department of Armstrongs, a much respected and capable figure will be removed from active participation in the industrial life of Tyneside. A pleasant function marked his retirement last week, a presentation being made to him on behalf of the officials and staff of the Walker Yard and some of those associated with the naval yard. References were made on this occasion to the part played over a long period of years by Colonel Saxton White in establishing the high reputation of Armstrongs on the shipbuilding side. Concurrently with the announcement of this retirement comes the news that another well-known naval architect, Professor T. B. Abell, has been appointed Dean of the Faculty of Engineering at the University of Liverpool. He has already done good work there as Professor of Naval Architecture.

Engineering at the Post Office.

THE plea for independent control by engineers of the Post Office factories—hitherto under secretarial direction to a great extent—which was made by Mr. W. B. Pinching before the Select Committee, expresses an old grievance. This witness used strong and what will be generally regarded as justifiable criticisms of the present system. He submitted that the Holloway and Birmingham factories are not carrying out their duties as the workshops of the Post Office, and that to attain economy and efficiency of operation all the factories should be placed entirely under engineering control. Men in the factories claimed to have a better perspective than the average civil servant, for the reason that in most cases they received their training outside Government departments. Mr. Pinching compared the old National Telephone Company's system of repairs with that of the Post Office, to the great disadvantage of the latter.

The Haigh Alternating Stress Testing Machine.

THE alternating stress testing machine, designed by Professor B. P. Haigh, of the Royal Naval College, Greenwich, has been in existence for a number of years. An early example, constructed while Professor

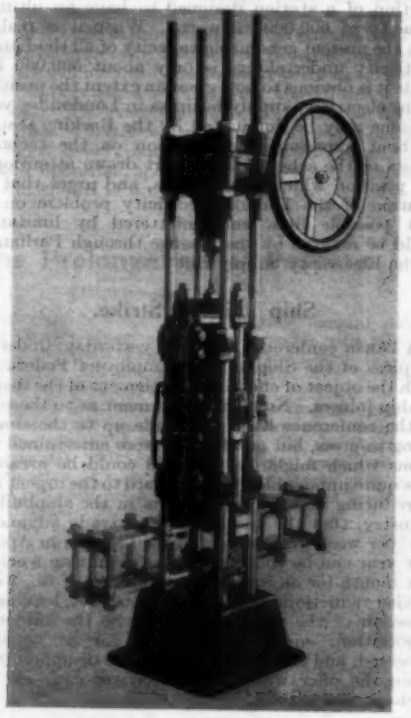


FIG. 1—HAIGH TESTING MACHINE

Haigh was at Glasgow University, was described in 1912 in a paper read before the British Association. Again, in 1917, in the course of a paper before the Institute of Metals on the fatigue of brasses, the inventor gave an outline of the general principle of the machine as it stood at that date. Up to the present, however, more attention has been devoted to the results of the tests conducted with the machine than to the details of the machine itself. It therefore seems desirable to publish a description of it in these pages, more especially as it is now being made in an

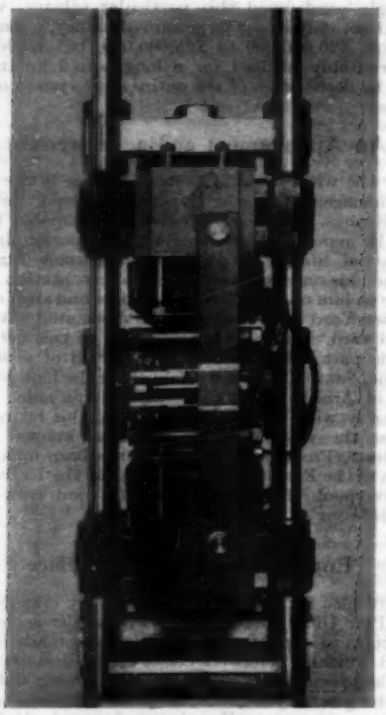


FIG. 2—MAGNETS AND CUT-OUT

improved form, and placed on the market by a well-known firm of engineers—Bruntons, Limited, of Musselburgh, Scotland.

Illustrations of the machine in its newest form are given herewith in Figs. 1 and 2, while in Fig. 3 the details of the essential parts are shown, although the actual design represented in the third figure is of a slightly less recent date than that shown in the half-tone engravings. The machine, it should be stated at the outset, is designed to apply, electro-magnetically, to metallic specimens a rapidly alternating or varying stress, ranging from a maximum to a minimum tension or from a maximum to a minimum compression, or, the more usual arrangement, from a maximum tension to an equal or unequal maximum compression. As contrasted with other fatigue-testing machines, it is distinguished by the ease with which the position and range of the applied stress may be varied, and with which the speed of testing may be changed, by the rapidity with which a complete fatigue endurance test may be carried out on it, and by the almost complete silence and absence of vibration with which it operates.

With the machine running at its normal speed, some 2000 stress cycles can be applied per minute to the specimen, or, roughly, one million in eight hours. The most searching practical fatigue tests rarely require the specimen to sustain without breaking more than six million cycles of stress. Such a test could be completed by the Haigh machine in two days and two nights. It may be added here that it can be left running unattended in the course of a test, and that it is provided with means for automatically stopping as soon as the specimen fails.

A test of the above description is, as we have implied, distinguished as a complete fatigue endurance test. A less complete test sometimes applied takes as the fatigue limit the maximum stress which the specimen can bear without fracturing after a million or some such similar number of applications. The Haigh machine is, of course, quite suitable for this limited—and probably in many cases untrustworthy—form of test. There is, however, a third form of fatigue test to which much attention has recently been directed, and from which, as will shortly be shown in these pages, much of great practical importance is reasonably to be expected. Under this test, first applied, we believe, by Mr. J H. Smith to tensile fatigue tests, and more recently confirmed by Mr. Gough, of the National Physical Laboratory, as applying also to torsion and bending fatigue tests, the specimen is not tested to destruction, and need not be in the machine for more than a few minutes. The procedure consists in applying an increasing range of stress to the specimen and observing, by optical or other means, how the strain grows. Up to a certain point, the strain grows proportionately with the stress, but at this point it quite suddenly increases more rapidly than the stress. This point is always less than the limit of proportionality as determined by an ordinary static test, and extended research shows that it is apparently identical with the fatigue limit for the same metal as found from a complete endurance test. It is also substantially identical with the fatigue limit as determined by the Stromeyer method; that is to say, by applying a thermo-couple to the specimen, gradually increasing the range of stress and noting the point at which a perceptible rise of temperature is suddenly indicated. It is important to notice that Professor Haigh's machine, although originally designed for complete fatigue endurance tests, can quite readily be adapted to the strain or the Stromeyer method, and that, indeed, it ought to prove a most convenient means of carrying out these newer forms of test, and therefore of helping still further to bring fatigue testing within the range of daily practical works routine.

In principle, the Haigh machine—as shown in the

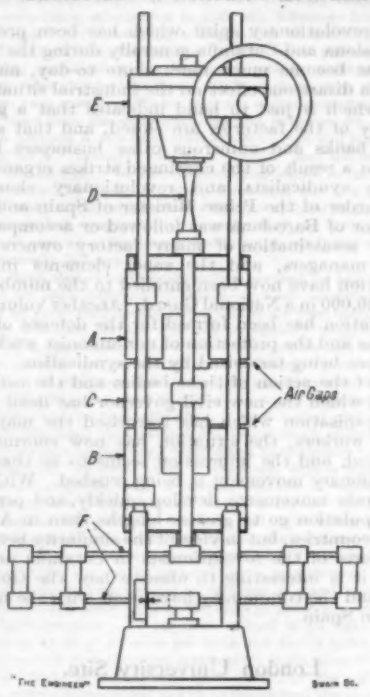


FIG. 4—DIAGRAM OF MACHINE

diagram, Fig. 4—makes use of two electro-magnets A B, arranged one above the other vertically, with an armature C between. The armature is mounted on a central vertical rod, which at its upper end is yoked to the specimen D, the upper end of which is, in turn, fixed to the head E of the machine. The lower end of the armature rod is attached to an arrangement

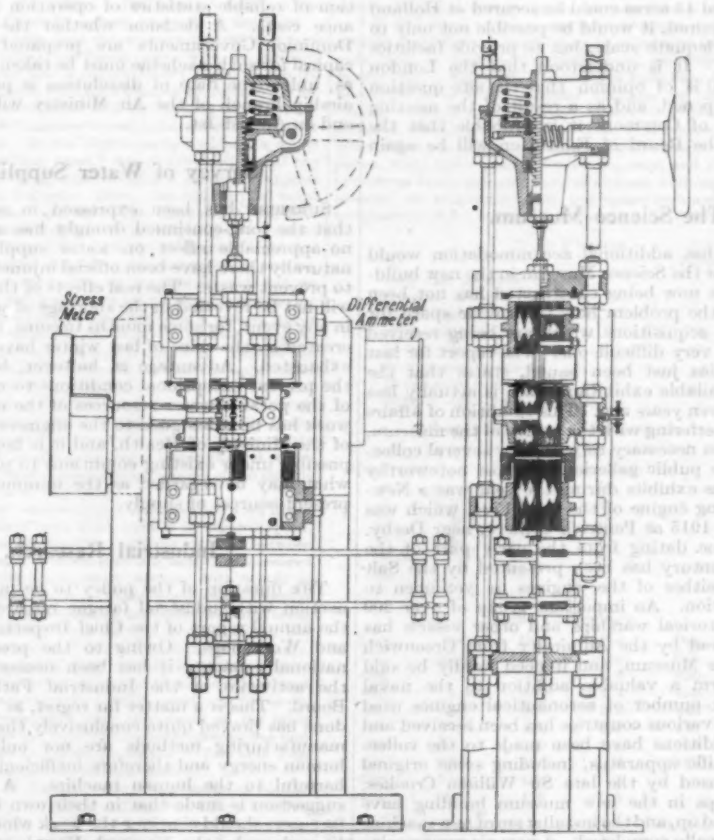


FIG. 3—HAIGH MAGNETIC ALTERNATING STRESS TESTING MACHINE

F, which may best be described as a spring beam, and which is supported at the mid point on the underside by an adjustable pin connection fastened to the machine base. The spring beam consists of two pairs of flat spring battens clamped together four-square-wise at each end with a pair of sliding clamps. By suitably adjusting these four clamps, the spring beam can be caused to exert on the armature rod,

either an upward push, a downward pull or no force at all.

The object of the spring beam is two-fold. In the first place, it neutralises the inertia effect of the vibrating armature and leaves the force applied to the specimen, the net force contributed by the magnetic flux. Secondly, the beam provides the means whereby the position of the range of stress may be varied. Thus, with the beam exerting no force on the armature rod, the range of stress will be, say, from 10 tons tension to 10 tons compression. With the beam exerting an upward stress of 10 tons per square inch, as measured on the section of the specimen, the specimen is initially subjected to a compression of this amount. The same flux density as in the previous arrangement would therefore produce a cycle of

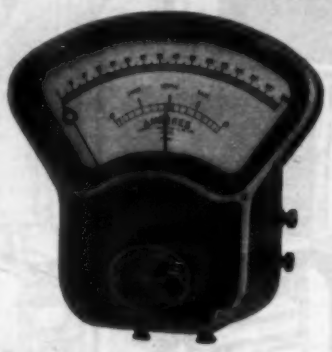


FIG. 5—COMBINED AMMETER AND STRESS METER

stress on the specimen ranging from 20 tons compression to zero. With the beam adjusted to exert a downward pull of 10 tons per square inch on the specimen, the range of stress would be from 20 tons tension to zero. The diameter of the specimen at its mid section is usually from 0.2in. to 0.3in., so that in the examples we have given the total force required to be exerted by the spring beam in order to produce an initial stress in the specimen of 10 tons per square inch is from 6 cwt. to 14 cwt.

The feature of the electro-magnets is that the current used is not direct but two-phase alternating, one phase being taken to the upper magnet and the other to the lower. The pull exerted on a plain steel armature by an electro-magnet supplied with direct current is proportional to the flux density, and therefore to the voltage, and varies inversely as the square of the air gap. With an alternating-current magnet, however, the force is proportional to the square of the flux density, and therefore to the square of the voltage divided by the frequency, and up to a certain small limit is substantially independent of the air gap. In the Haigh machine the two phases of the supply are separated by 90 deg., and cause two fluctuating magnetic forces to be applied to the armature, which do not neutralise each other, but which add up to a resultant force tending to make the armature move upwards and downwards at a vibratory speed equal to twice the frequency of the supply current.

The stress applied to the specimen follows a wave curve on a time basis. The mean line of this curve may represent a tension, a compression or a zero stress, its position being governed, as we have already explained, by adjusting the force applied by the spring beam to the end of the armature rod. The height of the curve from the crest to the trough, representing the range of stress applied to the specimen, is governed by the voltage of the supply current. The horizontal distance from one crest to the next is an inverse measure of the number of stress cycles per minute to which the specimen is being subjected and can be varied—as would be required in an investigation into the effect of the speed of testing on the fatigue limit—by varying the speed of the alternator, and therefore the frequency of the supply current.

The alternator is equipped with a revolution counter. At the end of a test the number of stress cycles borne by the specimen is determined by reading this counter and doubling the number indicated. An automatic cut-out is provided, as previously stated, to shut down the alternator as soon as the specimen fails. It has been found important to make the action of this cut-out as instantaneous as possible, not because a couple of hundred or so extra turns of the alternator would produce a wrong reading at the revolution counter—200 being negligible in a total of two or three millions—but because, in order that the nature of the fractured surfaces may be examined, it is essential to avoid the broken ends of the specimen hammering on each other. The automatic cut-out is actuated by a finger projecting from the armature and vibrating between a pair of adjustable points on two springs, which also carry a pair of electrical contacts. When the specimen breaks, the slightly extended movement of the armature lifts one or other of the electrical contacts, and thus causes the motor driving the alternator to shut down.

The details of the machine will be gathered from the general drawing reproduced herewith as Fig. 3. The upper end of the specimen is attached to a screwed shaft, which can be raised or lowered by means of a worm wheel nut. The nut is in two parts, the lower portion resting on a ball thrust bearing and the upper being pressed downwards by means of helical springs. By this arrangement, the effect of any backlash between the nut and screw is eliminated. The necessity for providing means whereby the upper end of the specimen can be lifted or lowered arises from the fact that the air gaps between the armature and the magnets must be equal, whether the range of stress is equally or unequally disposed about the datum line. Without some such means as indicated, the application to the specimen of initial loading by the adjustment of the spring beam would upset the equality of the air gaps.

In the general drawing, the machine is shown equipped with a differential ammeter—used for balancing the currents in the two phases—and a stress meter, whereby the range of stress applied to the specimen can be determined. In the latest form of the machine, as illustrated in the half-tone engravings, the framework has been considerably modified in design, and the ammeter and stress meter—combined in one instrument, as shown in Fig. 5—have been removed from the frame and arranged for attachment to a neighbouring wall. The range of stress applied to the specimen varies, as we have said, in proportion to $(E/f)^2$. The stress meter scale is evenly divided, and reads stress directly without reference to the voltage or frequency. The instrument, in order to secure this requirement, is of special design, and is provided with a choking coil in place of the resistance used with the ordinary voltmeter.

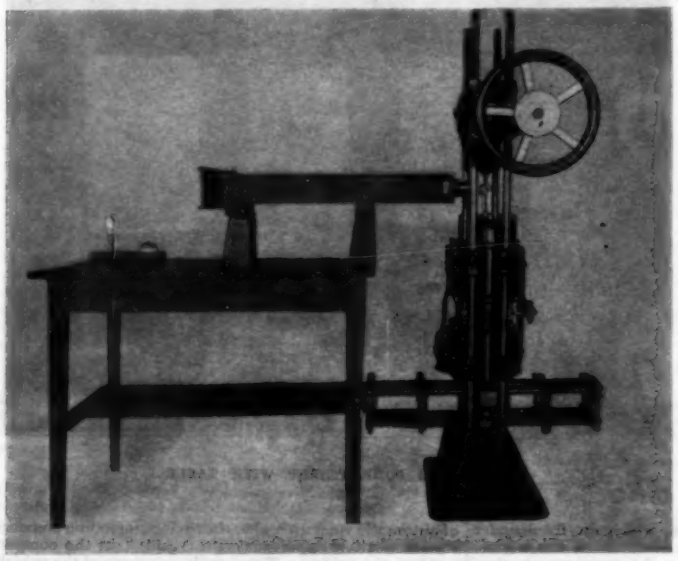


FIG. 6—HAIGH STRESS MACHINE WITH EXTENSOMETER AND CAMERA

The machine lends itself, not only to fatigue tests on ordinary specimens, but to the investigation of the failure by fatigue of structural parts or models thereof. It can further be readily arranged to carry out fatigue bending tests. In such an instance, the specimen—say, a turbine blade—would be arranged horizontally with one end clamped in a vice-like arrangement attached to the head of the machine, and with the other end yoked to the armature rod. By means of a mirror extensometer and a ground glass screen or camera arranged as shown in Fig. 6, an optical indication or record of the strain suffered by the specimen can be obtained. At the Naval College Laboratory, Professor Haigh has arranged the optical apparatus with a multi-sided mirror interposed between the extensometer and the ground glass screen or camera. When this mirror is set rotating at a speed in harmony with the rate of application of the stress cycles, the curve projected is of steady sine form and clearly illustrates the nature of the stress being applied to the specimen.

SURVEYS are being made in Southern California with the idea of developing 2,500,000 horse-power at Diamond Creek and Marble Canyon, and transmitting power to Arizona and the adjoining States.

New Dutch Patent Law.

VERY important changes have recently been made in the patent laws of Holland and should be studied by British inventors or patentees likely to have an interest in that country. The law has been passed, but presumably has not yet been put into force, although there is reason to believe that it will shortly come into operation. The most important change is that which deals with the examination of a specification based on an application or patent previously filed in a country foreign to Holland. If an application has been filed for the same invention in such country the applicant for a Dutch patent is required, on the request of the Examiner, to state the objections which have been made during the examination of his application in the aforesaid foreign country. This is a very far-reaching condition and one open to objection. Under it the Dutch Patent Office appears to be able to demand information which might be to the detriment of the British inventor. Assume, as is often the case, that an application filed in this country covers more than one invention. It may happen that during the examination proceedings one part is shown to be old and the other, although new, may be to a certain extent, or even possibly not at all, affected by the patents disclosed. It would appear that the whole of the disclosure as found by the British Examiner will need to be communicated on request to the Dutch Patent Office, and, having regard to the difference between the attitude of that Office to the subject matter of an invention and the attitude of the British Office, the specifications which were not relevant to the important part of the British application—possibly the sole remaining part—might be considered by the Dutch Patent Office to be sufficient to bar the grant of a Dutch patent. The onus should not be placed on a British inventor of supplying to a foreign Patent Office the results of a search in this country, for which he pays by means of the sealing fee on the British patent. The matter is rendered more harmful because the results of searches made by the Patent Offices of, say, Germany and the United States of America also, presumably, would need to be communicated to Holland on request. Among the other amendments to the law there is an important and helpful amendment which enables the original date to be given to an applicant for a divided application should the Dutch Patent Office hold that his specification contains two inventions.

In passing we may notice an article which was in the last Dutch law also and might well be introduced into the laws in this country, providing that the invention by a person in the employ of another, the nature of the employment requiring the application of special knowledge for making inventions of the same kind as that to which the application relates, is the property of the employer, but the inventor must be recompensed, if not by his salary, then by a special remuneration. On the contrary, if the inventor prove that the merit of the invention is due to him alone to the exclusion of others, the Patent Office may order his name to be mentioned in the patent. The wording of the contrary clause might possibly be strengthened to make it clear that if the invention does not arise from the nature of the special employment then it is the property of the inventor and not the employer.

The new Patent Act has been largely modified in respect of secret patents. If, in the opinion of the Examiner, the remaining secret of an invention may be of interest to the country he may notify the applicant to that effect. Further, it appears that it is now possible for the State itself to file a patent application for an invention, the remaining secret of which the State deems to be in the interests of the defence of the country. Special provisions are made permitting expropriation of patents, and in that event it is provided that the Patent Office shall appoint three experts, who shall fix the amount of indemnification in case of expropriation.

New Bournemouth Trains.

THE London and South-Western Railway Co. is now putting eight entirely new trains on its Bournemouth service. At present, we believe, two of the trains have been completed and the others will shortly be ready. The coaches, which are of the corridor type, have been built to the designs of Mr. S. Warner, the company's carriage and wagon superintendent. Each train has seating accommodation for 42 first and 154 third-class passengers and consists of five coaches as follows:—

Two third class brakes, each having four passenger compartments, one lavatory, and one baggage compartment;

One entire Third Class coach, having eight passenger compartments and two lavatories;

One Pantry Third Class coach, having seven passenger compartments, one lavatory, and one pantry; and

One entire First Class coach, having seven passenger compartments and two lavatories.

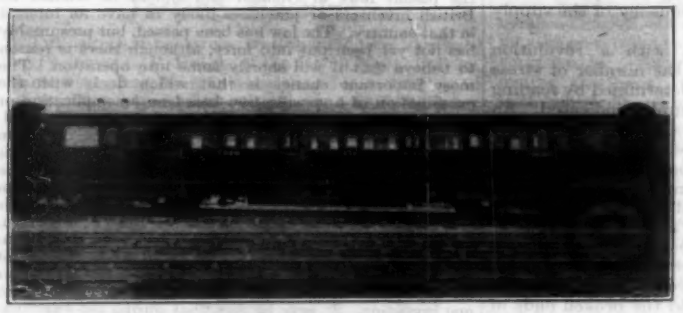
The following is a list of the principal dimensions which are common to all the coaches:—

Length over buffers	60ft. 7in.
,, bodies	57ft. 0in.
,, headstocks	56ft. 11in.
,, centres of bogies	41ft. 0in.
,, bogie wheel base	9ft. 0in.
Width outside waist	9ft. 0in.
Width at cant-rail, outside	8ft. 9in.
Height from rail to outside roof	12ft. 5in.

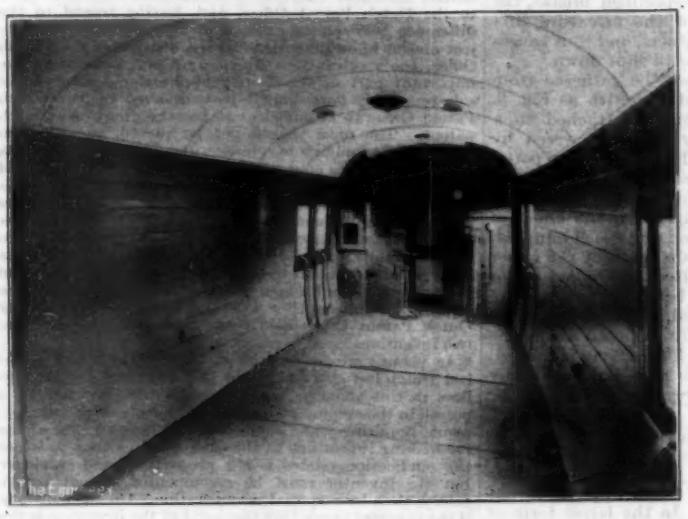
The outside panelling of the bodies is entirely of galvanised steel, which is screwed to framing of teak and oak. The bottoms are framed with oak, and the bays thus formed are fitted with galvanised corrugated steel and filled in with "Sanolit" so as to provide a fireproof floor, which is both solid and hygienic. The underframes are constructed of steel channels and angles and the buffing shocks are absorbed by double buffers having india-rubber springs. The heads of the buffers are 16in. in diameter. The draw gear is of the company's usual type. It is fitted with three india-rubber springs at each end of the underframe behind the bolsters. The four-wheeled bogies are also of the company's standard type. They have long bolsters which carry the side friction blocks out

L. AND S.W. RAILWAY NEW TRAINS FOR THE BOURNEMOUTH SERVICE

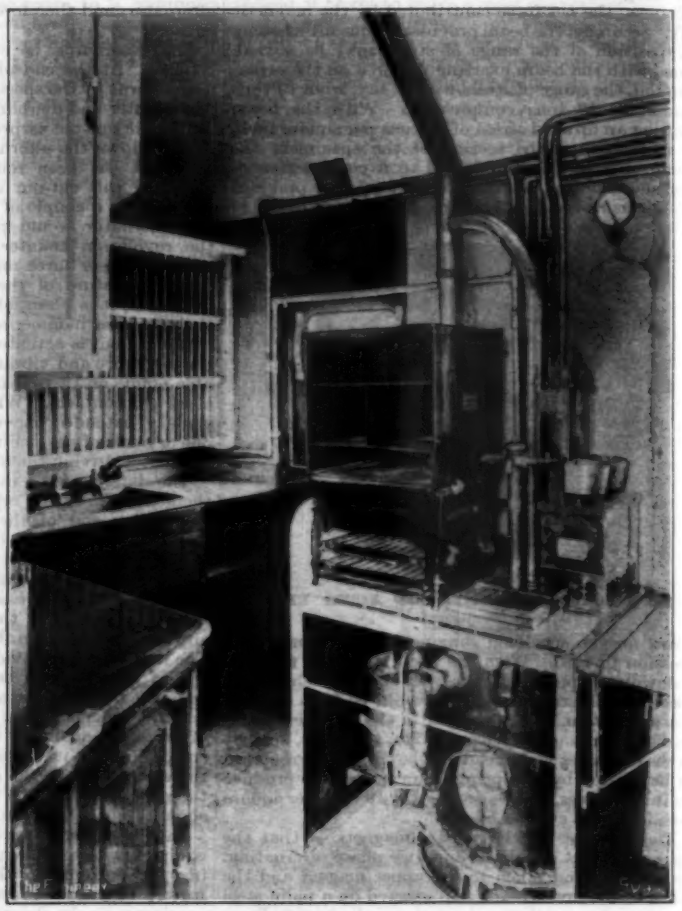
MR. S. WARNER, EASTLEIGH, ENGINEER



A THIRD-CLASS COACH WITH PANTRY



INTERIOR OF LUGGAGE COMPARTMENT



INTERIOR OF PANTRY

THIRD-CLASS COMPARTMENT

FIRST-CLASS COMPARTMENT WITH TABLE

to the underframe sole bars, so as to reduce the oscillation of the coaches to a minimum. The top bolsters are supported on coil springs, while the bottom bolsters are carried by means of spring links. The wheels, which are of the solid disc type, are 3ft. 7in. in diameter. The axles have 9in. by 4½in. journals, the centres of which are 6ft. 8in. apart. The laminated side springs are fitted with concentric india-rubber springs so as to provide an additional means of absorbing shock.

A feature of each train is the provision of a pantry, which is fitted with cupboards, drawers and shelves for the storage of cutlery, crockery and food, as well as with a sink furnished with hot and cold water supply for washing-up purposes. There are also a boiler having a capacity sufficient to supply tea to all the passengers in the train, an egg cooker and a grill.

Electric light is fitted throughout the trains. The first-class compartments have two lamp brackets for each partition just below the parcel rack, as well as one lamp in the roof. The third-class compartments are fitted with three lamps in the roof only. There are four lamps in each corridor and one in each lavatory. Ventilation is provided for by means of drop lights in the sides of the vehicles and by air extractors fixed outside above the drop lights and fitted with regulating shutters inside the compartments. Air extractors are also fixed in the roof of the pantry and luggage vans. The company's standard electric bell communication is fitted throughout each train. Heating is effected by means of low-pressure automatically-regulated radiators, which are fixed under the seats and are supplied with steam from the engine. Portable tables can be fitted in each compartment when required.

The lavatories have their walls lined with enamelled plates, which enable thorough cleansing to take place with a minimum amount of labour. Hot and cold water is supplied to the hand basin, the hot water being delivered from a steam water heater.

The illustrations which we give show well the interior arrangement, decoration and upholstering of the coaches. Spring roller blinds are fitted to all the passenger compartment windows, and brass hand rails are fixed across the large windows in the corridors. The compartments are separated from the corridor by sliding doors which have drop lights. The guard's and luggage compartments in the Third Class brake vehicles are 28ft. 2½in. long. They are fitted with four pairs of hinged double doors. A set of emergency tools and a first-aid medical chest is fitted in each of these compartments. Owing to the loading gauge limit, the guard's look-out could not be made to project beyond the body; so, in order to obtain the necessary projection, the body of the van has been gradually decreased in width from 9ft. to 8ft. 3in. in a distance of 7ft. 10½in. to within 2ft. 6in. of the end of the coach, where it is again made full width, so that a projection is formed, in which a window is arranged, which enables a good view of the signals to be obtained from the guard's seat.

The trains are equipped throughout with the latest type of automatic vacuum brake, the fittings including passenger communication apparatus with "pulls" in the compartments and corridors. The outside colouring of the vehicles is dark green picked out with black and lined with yellow, the lettering being in black and gold.

THE growing market for electrical machinery, which is provided by China, is indicated by the following list of recent installations, taken from the *Journal* of the Shanghai British Chamber of Commerce:—One 3000-kilowatt turbo set (German make) for the Chinese Tramways, Shanghai; one 1000-kilowatt turbo set (U.S.A.) for the Tsinanfu electricity works; one 2500-kilowatt turbo set (British) for the Peking Chinese Electric Light and Power Company, Limited; one 1000-kilowatt set (U.S.A.) for the new power station at Nanking; one 200-kilowatt set (British) for Szechuan; one 100-kilowatt set (British) for Kiangsi; 2-6000-kilowatt sets (Swiss) for the Kailan Mining Administration, and Anglo-Chinese Mining Company, and 2-3000-kilowatt sets (German) for Nantungchow. In Tientsin, the foreign operated electricity undertakings, namely, the Belgian Tramways and the French Electricity Works, both placed orders for extensions, the first-named for one 5000-kilowatt set, and the last-named for one 1000-kilowatt set, while towards the end of the year the new British Municipal Council Electricity Department placed an order for two 1000-kilowatt sets together with necessary boiler plant.

Railway Matters.

On the 18th inst. Sir Eric Geddes stated that the very large increase in the cost of traders' tickets—an instance was given where a ticket was now over £240, as compared with £60 to £65—had been referred to the Rates Advisory Committee for inquiry.

The recent long spell of fine weather and of abnormal heat has led to many fires on and near the railways. One such fire, on July 12th, spread until it caught the wooden-built station at Northope on the Heckmondwike deviation of the London and North-Western Railway, which was completely destroyed.

The Nord-Sud system of underground railways in Paris differs from the Metropolitaine in that the latter is owned by the municipality. It has now been decided by the Municipal Council of Paris to purchase the Nord-Sud. There has always been a complete interchange of tickets between the two systems.

The original proposals in the Railways Bill as to the number of directors for each of the six groups of railways, as laid down in the second schedule, were that there should be twenty-one directors. It has now been agreed that this number shall be retained for the Southern Group, the Western Group is to have twenty-five, and the two larger groups twenty-eight each.

Practically all the pre-war travelling facilities have now been restored, but at advanced prices. There are fifteen and eight-day excursions, day excursions and even market tickets. Now it is announced that as from August 19th week-end tickets and commercial travellers' tickets are to be restored. These will be at a single fare and a-third for the double journey.

The general superintendent of the Midland Railway sends us a copy of the *Railway Gazette* for July 8th last, in which a complete account of the train control system on the Midland Railway is given. As the description occupies over fifty of our contemporary's pages, to say nothing of charts and diagrams, it may be gathered at once how complete it is and how complex is the system.

A very worthy form of war memorial is that of the workmen in the Midland Railway Company's carriage and wagon works at Derby. Over 1800 men joined up and 220 made the Great Sacrifice. These workmen raised altogether £3800 for various relief funds, such as the Red Cross Society and St. Dunstan's, and £1000 of this amount has been given to the Derbyshire Royal Infirmary for the endowment of a bed as a war memorial to their fellow-workmen.

The matter of the interim dividends for the railways of the United Kingdom is giving some anxiety. Control ceases on August 15th and, thereafter, the companies will themselves have to make the receipts balance the expenditure, payment of fixed charges and of dividends. All that the British companies may rely upon is the £30,000,000, less income tax, payable at the end of the year in settlement of all claims. In view of the uncertainties of the future the Midland Company—the first to declare an interim dividend—is paying at the rate of 3 per cent. per annum instead of at 4 per cent. as a year ago.

The terms as to the payment of the £60,000,000 have now been agreed to. The amount is to be paid in two instalments. Of the first, £25,000,000 are to be divided among the companies in proportion to their net receipts, and the remaining £5,000,000 among those companies which have suffered abnormally by the standardisation of rates of wages and other service conditions. Of the second instalment, £25,000,000 are to be distributed among those companies which on December 31st, 1920, were in arrears in respect of maintenance and wear and tear of track and rolling stock, and the balance is to be devoted as is the balance of the first instalment.

Speaking about the conditions of the Chilian loan—that it shall be spent in this country—the *Railway Age* (New York) of June 3rd said that "This is the most important evidence thus far that Britain is making progress in regaining her old supremacy in South American railway markets, and the spectacle is not one which indicates any particular competitive strength of Americans in the field. . . . In March last year our exports were valued at almost a billion dollars. In March of this year they had fallen to 384 million dollars. When these figures are understood it is not necessary to go much farther to find one of the primary causes for business depression in this country."

One of the good works accomplished by the Negotiating Committee of general managers and men's leaders was that part of the agreement made in January, 1920, whereby 512 out of the 700 different grades of railway servants were reduced to 88. Something similar has now been accomplished in the United States. During the period of Federal control the Inter-State Commerce Commission compiled a new classification of grades which brought the number down to 500. Nothing was done with this at the time, but through the recent action of the Railroad Labour Board it has now been put into force. The number of grades, 500, is greater than here, but it includes every rank on the railways from the presidents downwards, also every department.

In a paper on "Problems of Automatic Train Control," read before the Institution of Railway Signal Engineers on July 8th, Mr. W. J. Thorrowgood estimated the number of distant signals at 5750 and of running stop signals at 14,380. He placed the cost of the apparatus at £100 per engine and £75 per signal. Should automatic train control be provided there still would be eleven classes of accidents to be guarded against. There are seven different principles used in train control; one of these seven, mechanical, has three varieties; a second, electrical, has eight; and a third, magnetic, has two. He submitted eighteen questions which called for decision, and, added to these, there were the difficulties peculiar to electrically operated railways, also the question of brakes for goods trains. During the seven years 1907–1913 there was one collision for every 3,124,000 train miles run, and "It is therefore obvious that, to improve this, an almost perfect system is called for."

Notes and Memoranda.

The liquefaction of coal, which has puzzled many eminent scientists in all parts of the world, is claimed to have been successfully carried out, according to the *Iron and Coal Trades Review*, by a gentleman living in the environs of Sheffield.

Electricity is being used for rafting purposes for the first time in New Brunswick by the Nashwaak Pulp and Paper Company, at the mouth of the Nashwaak River, where rafts of logs are made up for towage to St. John. Two 20 horse-power two-phase motors and a crew of seventy men now do the work formerly requiring a crew of 200 men.

The American Society for Testing Materials has proposed that extra strength should not be provided in the designing of wooden floors to allow for suddenly applied loads. The justification put forward for the proposal is the experimentally established fact that a steady load has a more severe effect than a transitory load on timber structures.

Quantities of concrete piles reinforced with strips of bamboo have been employed with success on the Szechuan-Hankow Railway, China. The piles are 10in. by 10in. by 30ft. long, and reinforced by four ¾in. strips of green bamboo placed at each corner and wired together with square loops, also of bamboo 1ft. apart. The piles were driven by a monkey weighing one ton, having a drop of about 5ft.

For the purposes of keeping up communication between the various camps of a hydro-electric scheme in the mountainous district of California, wireless telegraphy has been adopted and has proved satisfactory even when a range 10,000ft. high separated stations 7 and 15 miles apart. The antennæ were hung from tall pine trees, and it was found that a continuous wave using a current of 2½ ampères gave better signals than a damped wave of 4 ampères.

In the official report on the explosion of a brewer's copper at Leigh, Lancashire, the accident is ascribed to the inability of the cast brass bolts, used to fix the cover, to withstand the stress imposed upon them. At the designed working pressure the load on the bolts would have been 1900 lb. per square inch of their section, but it is possible that the load was actually greater than this amount. It may be divined from the report, however, that the bolts were weakened by using the spanner too severely in tightening up the joint.

The damage caused by marine borers made it necessary to renew some of the piles under a wharf at Port Costa, California, and a special rig, described in the *Engineering News Record*, was prepared for the work. The pile driver was built up on a pontoon and had a mast 98ft. high with a jib 110ft. long. It was possible with this arrangement to reach right over the buildings erected on the wharf and drop the new piles through small openings made in the roof. Some of the piles were set at a distance of 90ft. from the water front of the wharf.

In a short editorial article in *British Machine Tool Engineering*, Mr. Arthur Smith says: "Beware of the man who is anxious to introduce elaborate systems, cost, efficiency, planning (card or otherwise)" or in the long run it will be found that the business is being run for the benefit of the system and not the system for the business. Elaborate and expensive costing systems are a bugbear. They were probably not noticed during and immediately after the war, but now that we are having lean times one must look for leakages and unnecessary expenses and cut them off. I have come across many works where pounds are being spent to find lost coppers."

Commenting on an article by P. H. Chen, on bridges and locomotives in China, the *Engineering News Record* comes to a point which, it is suggested, may prove to be of pivotal importance, namely, the behaviour of American and European locomotives. An experiment is recorded which shows that an American locomotive sets up lateral vibrations in a bridge several times as violent as those set up by a European locomotive. The test is perhaps too crude to be conclusive, but until disproved by more careful experiments it must be taken as indicating that American locomotives are needlessly rough on the structures that carry them. It would appear, says our contemporary, that there is a good bit of room for improvement in locomotive construction.

For the purpose of producing a black finish on small brass articles it has been found, according to the *Journal* of the Franklin Institute, that a sulphocyanate solution having the following composition is satisfactory:—Nickel ammonium sulphate, 8 oz. per gallon; zinc sulphate, 1 oz. per gallon; and sodium sulphocyanate, 2 oz. per gallon. It is desirable to keep in suspension an excess of zinc carbonate, which maintains the neutrality and the zinc content of the solution. "Black nickel" plating may be applied successfully to brass, either directly or after copper plating, to copper, and to steel which has been first coated with copper, nickel, or zinc. Where protection against corrosion is desired, the "black nickel" should be preceded by zinc plating. The wearing properties of the "black nickel" surface are largely determined by the quality of the lacquer subsequently applied.

Tests carried out on paint spraying machines have shown, according to the *Architect*, that spraying requires approximately 10 per cent. more paint than brushing when the surface being treated is an iron roof, while brushing requires approximately 200 per cent. more labour than spraying. On exterior brick walls spraying requires 7 per cent. more paint than brushing, while brushing requires 109 per cent. more labour than spraying. On interior ceilings and walls of plaster spraying requires 40 per cent. more paint than brushing, but gives a better hiding in one coat. On similar work brushing requires 160 per cent. more labour than spraying, and gives a poorer hiding in one coat. Although it has not been possible as yet to arrive at a definite conclusion confirming the relative durability of spraying as compared with hand painting, it is claimed that the investigation so far made tend to support the belief that the spraying work will last longer.

Miscellanea.

It is said that Mr. Henry Ford has made an offer to the American Government for the lease of the huge plant at Muscle Shoals, Alabama, for producing nitrates from the atmosphere.

The Tata Company is contemplating the erection at Jamshedpur, India, of plants for building railway wagons and locomotives, and the manufacture of agricultural implements, wire products, sheets, wire ropes, &c.

A large new glass factory has just been completed at Rio de Janeiro. The output, it is expected, will amount to 60,000 bottles and 20,000 other pieces a day, while it is hoped to produce, besides, all kinds of simple glass.

The disabled ex-Service men at the Leeds Technical School, under the auspices of the Ministry of Labour, have recently completed the construction of a 20,000-volt transformer to work on the Leeds Corporation electricity supply.

An experimental plant for dealing with oil shales has been put up at Rosedale, New Brunswick, Canada, by the Anglo-Persian Oil Company. It has a capacity of 8 tons a day, and a plant of 5000 tons capacity is being considered.

The Electricity Commissioners have extended the time within which objections or representations may be made, or any scheme may be submitted, in connection with the South-East Lancashire Electricity District, until October 31st, 1921.

According to the official returns, 179,100 tons of coal were raised in Great Britain during the period of the last strike. The largest contribution came from the Stafford district, where 77,500 tons were mined. Durham came last on the list, with 3400 tons.

Two prospectors report that they have found a hill of copper sulphides, measuring 80ft. above the water level of Lake Athapapuskow, Manitoba. The samples shown are high grade, and miners think it is running to 20 per cent. copper, with small gold and silver values.

A British company has recently obtained a concession from the Spanish Government to erect tank depôts and pumping machinery to supply steamers alongside the breakwater at Las Palmas. As a temporary arrangement oil is being supplied from a tank vessel, moored in the harbour, and having a holding capacity of about 7000 tons.

The Nankow works of the Peking-Suiyuan railway, China, are to be extended. The repairing shops for locomotives, wagons, and carriages, electricity power-house, machine shops, and stores will be enlarged to meet the increased needs of the railway. The establishment of similar works at Tatung and Suiyuan and warehouses at various other points is also under consideration.

It has been announced in Stockholm that the British Legation in that city has been requested to obtain statistical information regarding the Swedish telephone system and organisation with the object of placing such information at the disposal of the Committee recently appointed by the British Postmaster-General with a view to effecting cheaper running costs and lower subscription rates.

The Customs report on the foreign trade of China during 1920 shows that 44 per cent. of the imports and 39 per cent. of the exports were British. The corresponding amounts for America were 18 and 12 per cent., while the Japanese did 29 per cent. of the import and 26 per cent. of the export business. The British share of the imports had increased by 35 per cent. since 1913 and by 104 per cent. since 1919.

The 5-unit Kling-Weidlein cleaner, ordered some time ago by the Shelton Iron, Steel and Coal Company, is now completely erected, and will be put into operation as soon as the company's furnaces are again in blast. The results to be obtained by this equipment, which has excited a great deal of comment amongst blast-furnace owners, will be awaited with interest, and it is fully expected, says the *Iron and Coal Trades Review*, that these results will be equal to those obtained in several American installations.

A silver-bearing area, comprising 1000 square miles, which assays up to 7000 oz. of silver to the ton, is being rapidly developed in the Yukon, according to a Vancouver correspondent of *Canada*. Ore is being shipped which assays 200 oz. to 700 oz. per ton, with stringers of carbonite that go 1700 to the ton. The only thing that is handicapping this district, known as Camp Mayo, is the shortness of the open season on the Stewart River, and it may be necessary to build a railway to handle the output adequately.

The American Association for the Advancement of Science, which has a membership of between twelve and fifteen thousand, will meet in Toronto in December next. Like the British Association, it is divided into a number of sections, each presided over by a vice-president. One of these sections is devoted to engineering in all its branches, and we are asked to state that the officers of that section extend a hearty welcome to any engineers from the British Isles who can make it convenient to be in Canada at the time of the meeting.

Figures just issued in relation to the trade of China show that there is a growing market for electrical materials. The demand for electric lighting in most cities in China which possess generating plant generally exceeds the supply, most of the machinery being overloaded, a fact which is leading to an increasing disposition among Chinese to install small private plants, which are, at present, largely obtained from America. In many cities there are merchants sufficiently progressive to lay down small plants for the purpose of lighting their own and several adjacent premises. The latest Customs report says that "there is a tendency in the more important establishments to install larger units, and whilst a few years ago 200 and 400 kilowatts were considered large, it is now quite common to install units of 1000 kilowatts and upwards, and it is reported that a large number of orders has been placed for privately owned power stations for the purpose of supplying power to cotton and flour mills."

2330-I.H.P. DIESEL MARINE ENGINES

THE NORTH BRITISH DIESEL ENGINE WORKS, LIMITED, WHITEINCH, ENGINEERS

(*For description see page 109*)

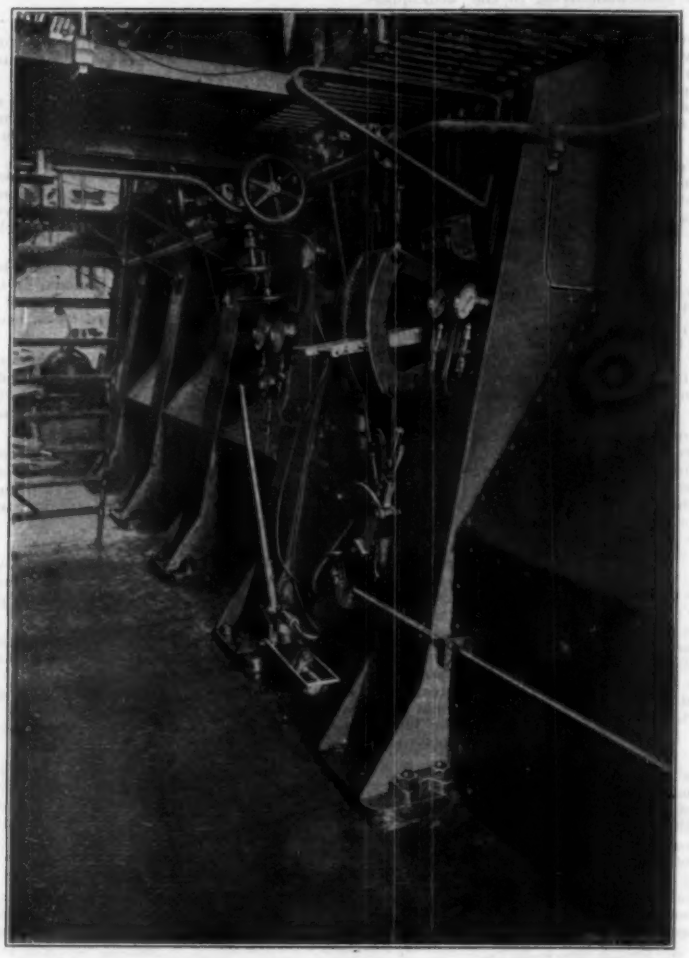


FIG. 15—CONTROL STATION

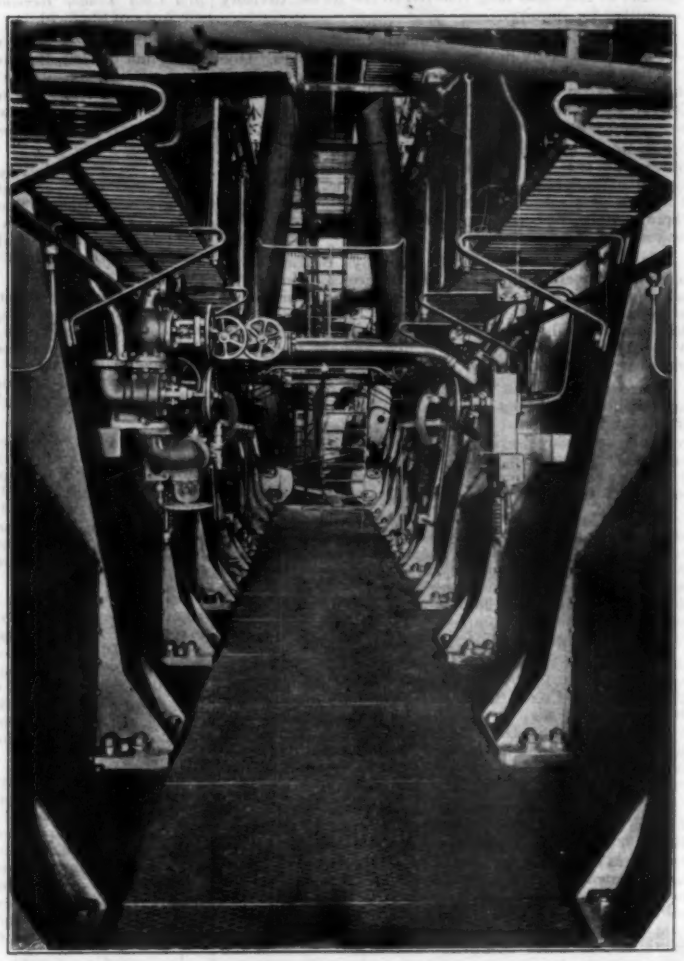


FIG. 16—VIEW BETWEEN THE TWO ENGINES OF THE DOMALA

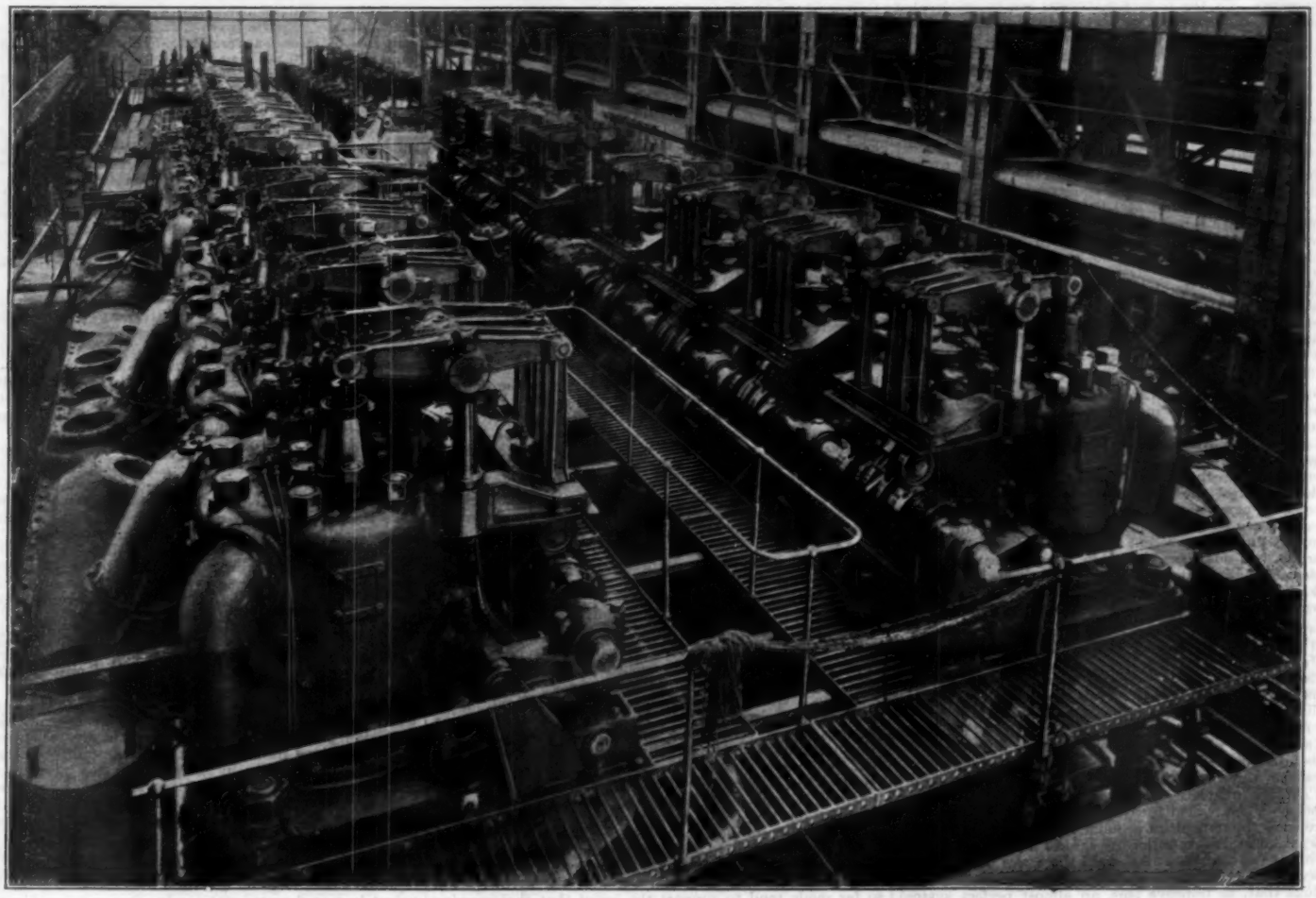


FIG. 17—THE TOPS OF THE CYLINDERS OF A TWIN-SCREW SET SHOWING VALVE OPERATING GEAR

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The Engineer

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DEATH.

ON July 20th, accidentally shot, OLIVER H. PORTER, of Baldaw, Lennoxtown, managing director of Messrs. R. and J. Dick.

THE ENGINEER.

JULY 29, 1921.

Brass and Bronze.

THE poet or the philosopher may well ask, "What's in a name?" but the advertising manager well knows the practical answer to that question. From the business point of view, there is a great deal indeed in a name—so much, in fact, that the result is sometimes seriously detrimental to all but the advertiser, whose goods may be sold on the strength of a name or a catch-word rather than on a basis of merit. Fortunately, however, this is true more of such popular commodities as, for instance, soap or toffee, than of the materials of engineering. Yet even in the business of selling materials—mainly non-ferrous alloys—intended for engineering uses, the effort to increase the attractiveness of goods by the aid of alluring names is not absent. We have, to begin with, a whole string of proprietary alloys endowed with the highest-sounding names, and in some cases it has even become difficult to avoid the inclusion of such names in standard specifications.

This state of affairs would seem to call for much closer attention to the names attached to materials than this subject has yet received, particularly from such a body as the British Engineering Standards Association. It is true that the Institute of Metals, some years ago, appointed a Nomenclature Committee, which issued one very useful report. But even in the papers published by the Institute of Metals itself the findings of this report have not always been strictly followed. During the war, the pressure of more urgent matters no doubt drove this question into the background, but the time would seem to be ripe for fresh efforts, either by the Institute of Metals or preferably by the British Engineering Standards Association, which has recently formed a new Sectional Committee to deal with the standardisation of non-ferrous alloys. Surely the standardisation of their nomenclature is one of its duties. That some such standardisation is necessary becomes evident when we see that such seemingly simple terms as "brass" and "bronze" are used in widely different senses. In fact, the first authentic definition of these terms appears to be that put forward by the Institute of Metals Committee already referred to. Under these definitions, "brass" is the name to be given to alloys of zinc and copper which contain more than 50 per cent. of copper, while "bronze" is to be used for alloys of tin with copper, with the same limitation. Where we have to deal with simple binary alloys or with alloys which only contain minor additions of other elements, this would seem to be a simple and straightforward proceeding, and to a very considerable extent it is followed in existing practice where no "trade" or traditional cause operates in a contrary direction. Such cases, however, exist in considerable numbers. The most prominent case is the alloy often called "manganese bronze," which in many cases is essentially a zinc-copper alloy containing small—sometimes a very small—proportion of manganese and iron. Under the Institute of Metal nomenclature, this should be termed a "manganese brass," but there still seems to be some aversion to such a term. It is quite seriously contended that the term "bronze" suggests a stronger, more reliable and more valuable or costly material than the term "brass," and that "manganese brass" would tend to command less confidence and a lesser price than "manganese bronze." But surely this is only a transference to the field of engineering of the ideas of the retail trader in domestic commodities, and it is a poor compliment to the intelligence of the engineer to suggest that his choice of materials would be influenced in any serious degree by such considerations. Such materials, after all, are purchased on any considerable scale solely by specification, and there the chemical composition and the physical properties are usually stated with unequivocal clearness. An incorrect name at the head of such a specification can hardly affect the material advantageously, although it is in itself misleading and undesirable.

A more serious case against the rigorous use of the systematic nomenclature based on the standard definitions of brass and bronze which we have quoted above can be made out for such materials as are employed for other than directly engineering uses. Perhaps the best example is the alloy which was formerly known as "German silver," and was renamed during the war "nickel silver." Both these names are simply misleading, since the alloy, although of approximately "silvery" whiteness, contains no silver, and in no other way bears any resemblance to that metal. It is, however, used as a substitute in the manufacture of tableware, serving as a basis for electro-plating, &c. Now this is an alloy, or rather a group of alloys, which vary within very wide limits, containing nickel, zinc and copper. Strictly, this is a "brass" with an addition of nickel, and would thus be termed a "nickel brass." It is claimed that this alloy, which is used with satisfaction under the name "nickel silver," would be scorned if correctly described as "nickel brass." We are here dealing with a field in which questions of domestic consumption play an important part, and there—as we have said—the name holds its greatest sway. It may, perhaps, be asking too much to demand that technological exactitude should rule supreme in such an industry. For metals intended for engineering uses, however, it is high time that misleading and high-sounding names should be abolished and replaced by simple systematic names which give a true indication of the nature of the material, or else—where that is too complex—serve merely as an index letter or number.

Locomotive Operation Superheating and Firing.

IN our issue of July 15th we had something to say on the subject of locomotive operation, dealing more particularly with the use of the regulator and reverse gear. We now propose to refer briefly to the question of firing and to the handling of superheated locomotives, with special reference to the value of the pyrometer as a factor in their successful operation. Those who read the articles on "Locomotive Footplate Experiences," which have recently been concluded in our columns, must have noticed that whilst, as would be expected, most of the locomotives mentioned were superheated, very few were fitted with pyrometers.

Our readers will, we feel sure, be at one with us if we assert that the superheater is unquestionably the most important improvement made to the locomotive in modern times. The superheater, valuable as it is, is at the same time a sensitive apparatus. It must not only be properly maintained, but superheater locomotives must be carefully operated, more particularly as regards the method of firing and the use of the injector. It is possible so to fire that, although a good head of steam may be maintained, yet, owing to the generation of smoke, the superheater works inefficiently owing to the deposition of soot and the relatively low temperature of the gases. Again, it is easy so to carry the water in the boiler that the superheater will be called upon to evaporate water carried through the "regulator" instead of fulfilling its proper duty of superheating steam. When running it is difficult to tell just how high the water is in the gauge glass, and further, in modern boilers, by reason of their size, the height between the working level of the water and the regulator valve is considerably less than formerly, thus greatly increasing the possibilities of priming. With

locomotives working with saturated steam, priming is easily detected, but on a superheater engine a pyrometer is essential to indicate whether priming is taking place or not. What the pressure gauge is to the boiler so the pyrometer is to the superheater. Without it we cannot know if superheated steam is being supplied to the engines, nor can we know if the steam is hot enough. Any lower steam temperature than that possible under the working conditions means a direct increase in fuel and water consumption. Hence, since a pyrometer shows if the firing is right, it is, in our opinion, absolutely necessary for the proper working of the superheater. It provides the only means of knowing if the superheater is supplying superheated steam or generating relatively cold steam and sending it to the cylinders. For these reasons it is desirable that a really trustworthy pyrometer for locomotive work should be produced. We are told by a chief mechanical engineer of great experience that all the pyrometers so far produced leave something to be desired. The problem is an exceptional one, and we suggest to the makers of these instruments that they should give it special attention.

In the methods of firing our representatives found some diversity, but the differences were to a great extent in the amount of fuel thrown through the fire-door at each round of firing. Thus some men fired five or seven scoops of coal at a time, and others about ten or twelve, and on one line firing was less frequent and in larger quantities. Fire-doors were kept closed and the men in all cases shut the door after each scoop of coal had been thrown in. That is, of course, as it should be, for all the air necessary for combustion should come through the fuel bed from the ash pan. The fire-box heating surfaces receive their heat by radiation and by convection, but the latter plays only a small part. Only a small portion of the fire-box gases actually pass over the fire-box heating surfaces, which receive most of their heat by radiation from the fuel bed and from the luminous flame with which the fire-box should be filled. Hence it follows that fuel should be applied in small quantities in order that flame may be maintained and the fire kept as clear as possible. The amount of fuel fired will depend in part on the size of the grate and in part on the rate at which the fuel is being burned, which will depend in turn upon the power being developed. In general, the old adage, "a little at a time and often," is a good rule to work on and seems to be followed by most firemen. Closely allied with the subject of firing is that of steam pressures, and we note with satisfaction the steadiness of the pressure gauge readings. All the records were good, and in particular we would mention those given for the first trip from Paddington to Bristol over the Great Western, when the average steam pressure—the mean of sixteen readings—was 217 lb., equal to 97 per cent. of the maximum working pressure of 225 lb. The most important part of a locomotive designed for high speed service is the boiler, large heating surfaces to provide for the rapid generation of steam being absolutely necessary. It is satisfactory to be able to say that, judging from the complete information relative to the steam pressure recorded by our representatives on the various runs they made in all parts of the kingdom, that the modern express engines on our great main lines are all amply provided in this respect.

Of all the engines invented by man none has a harder task than that of the locomotive. It has to work under conditions which would be the despair of those accustomed to the comfortable lot of the fixed engine. Its boiler is in a state of incessant agitation, now moving up and down, now flung violently from side to side; anon, when ascending a hill, with all its water over the fire-box, and again, when descending, with the crown in danger of dryness. Few of the moving parts of the engine are rigidly fixed in relationship to each other. The crank shaft is continually moving out of dead line with the cylinders. The valve gear has to battle with similar adversities. Then, rigid as the frames may be, they twist and bend under the sudden forces to which they are subject. Everything that one would *not* desire happens to the locomotive. And yet it performs its duty with a certainty and efficiency that in the circumstances would surprise an engineer from Mars who was accustomed, let us suppose, only to the fixed steam engine. It is perhaps in large part because the steam locomotive engine leads a life of such unremitted diversity and excitement, so different from the easy career of the fixed engine that it has always exercised a fascination greater than that of its stationary brother. It has now to meet a new and active competitor in the electric locomotive. It may, after many years, go under in the contest, but we shall ever remember that it was by the daring, the skill, the patience, the inventiveness of steam engineers that railways were built up, and we shall never forget what we owe to that splendid line of men who for nearly a hundred years have driven steam locomotives with a loving care and intelligence not surpassed by the greatest and best of McAndrews.

The Electrification of Railways.

IT will be recalled that in the Interim Report of the Electrification of Railways Advisory Committee, issued in 1920, there are two points which have given rise to much comment, namely, the advocacy of a standard system, which shall be direct current at 1500 volts, and the recommendation that the energy should be generated in the form of three-phase alternating current at the frequency which is in general use in the district. In connection with this general question we have approached Mr. George Gibbs, the great American authority on this subject, and have invited him to express his views. He has kindly done so, including, of necessity, certain parts of the evidence which he laid before the Advisory Committee. We may, perhaps, remind our readers that Mr. Gibbs is acquainted with the general conditions surrounding the operation of British railways, having resided in England some years ago for about a year's time, as chief engineer of the British and Continental Westinghouse Companies; that he has also spent a portion of his time for the last twenty-five years in England each year, with the exception of those covered by the war; that he was, in part, responsible for the plans adopted in the electrification of the Metropolitan District Railway in London and of the Mersey Railway between Liverpool and Birkenhead; and finally, that as chief engineer in charge of design and construction, he has been responsible for all the electrification carried out by the Pennsylvania Railroad and its subsidiary companies.

MR. GIBBS' STATEMENT.

STANDARDISATION.

I.—System.—I am not of opinion that at the present time one system of traction at a suitable pressure should be applied as a standard to meet all requirements of railway traffic in Great Britain. Admitting the advantages of standardisation in general, yet I believe the establishment of any one system of electrification as standard for British railways would be a mistake at the present time, because:—

(1) It is too early in the state of the art to determine and fix the features of any system to the extent required for the purposes of complete standardisation, and yet not restrict the future and desirable development of the system selected.

(2) There do not exist sufficient and comparable operating data from which to conclude as to the relative advantages and disadvantages *for the future* of the two radically different systems most prominently before the railways to-day, *i.e.*, the "direct current" and the "alternating current." Both systems are workable and in use; each has its advocate in important manufacturing interests, and able professional men differ as to which system should prevail. This competition of diverse minds in the development of these different systems is an important factor in ensuring the future determination of the best system; it should not be discouraged by the premature exclusion of either system from trial in the present development period.

(3) Neither system, as now developed and applied to a typical general case, differs greatly in first, operating, and upkeep costs; therefore, railways will not be greatly penalised, except by hampering interchange, by being allowed to work out for the time being the full possibilities of the different systems.

Per contra, I am in favour of certain exclusions and the fixing of certain general requirements of any permitted traction system; thus:—

(1) I recommend standardising the location and clearances of third rail and overhead working conductors.

Standards for these have been established for American railways by the American Railway Association. The figures will, of course, differ for British railways. Standardisation of this kind will permit the continued development of both the alternating-current and direct-current systems of traction and will ensure interchangeability of running requirements between roads using the same character of traction system.

(2) Standardising suitable and safe limits for voltages in each of the two types of working conductors. These should be as follows:—

(*a*) *Third Rail.*—600 volts (nominal) direct current is recommended. A higher voltage than the above is, in my opinion, inadvisable for *general* railway usage, because employees or others who have access to the right of way cannot be effectively safeguarded from accidental contact with it. Contact with voltages of 1200 to 1500 is generally fatal to human life.

(*b*) *Overhead Conductors.*—The recommended voltage is 11,000 for the alternating-current system and 3000 for the direct current.

In the case of the alternating-current system the maximum is determined by the practical limit in maintaining insulation; 11,000 volts (nominal) is below this point, but experience indicates it is high enough for the heaviest kind of traction and is suitable for any class. A collector system carrying it can be installed and maintained properly and economically within close permanent way and rolling equipment clearances. It should be noted, however, that in an overhead wire system such as the three-phase, which requires two contact wires, insulated from each other and from earth, and two current collectors of different polarity, the practical voltage limit is considerably lower than 11,000.

In case of a direct-current system maximum voltage is limited by other considerations than that of insulation of the working conductor. The demands of economy in distribution and the problem of successful collection of current for heavy trains suggest the highest possible voltage; on the other hand, the limitations in respect of its utilisation in the train control and motors point to the desirability of low working voltage. For the general case I am of the opinion that 3000 volts is the minimum requirement from the standpoint of economy and successful current collection, and is the present maximum allowable for the other considerations.

II.—Frequency.—(*a*) Current frequency should be standardised for traction systems in accordance with the requirements of such purpose and not by a compromise with the conflicting requirements of another service.

(*b*) A frequency of 25 cycles per second is the best for both systems of traction recommended for trial, and should, therefore, be made the standard for traction generating plants.

III.—Generation.—High-pressure three-phase generation is suitable for both alternating-current and direct-current traction systems, and may be made standard.

The *voltage* at the generating plant may properly depend upon the local situation; it is quite immaterial for standardisation purposes what this actually is, as the voltage is transformed for secondary distribution, and various primary voltages may be utilised in the traction installation of one railway.

A consideration of "frequency" is highly important and no standard should be proposed which will exclude, materially complicate, or hamper the development of either of the two systems suggested.

One of the features making for simplification in the single-phase alternating-current system is that current from the generating plant is used in the working conductors without change, except, if desirable, by altering the voltage in a transformer. It is essential, however, that the "frequency" employed in the working conductors shall not exceed 25 cycles per second. If a higher generating frequency than the above is standardised it would complicate the alternating-current system; thus to utilise 50 cycles it would be necessary either to employ "frequency changers" or to install in the central station separate 25-cycle generators for railway purposes. The latter plan is employed to some extent in America, and it is found practicable for electric supply companies to install in the same station high-frequency generators for commercial purposes and 25-cycle generators for railway work and provide one or two large motor units for interchange of power between the two parts of the station.

With the direct-current system which employs alternating-current generation and transformation and conversion in sub-stations any desired frequency from 25 to 50 (or more) cycles may be used. Twenty-five cycles is, however, not only a suitable standard for the direct current, but is from some considerations better than a higher frequency. Therefore:—

(1) Three-phase, 25-cycle generation at any desired voltage or voltages should be specified as a requirement to allow the flexible development of electric traction systems.

(2) Commercial power plants, which employ other frequencies, may be utilised for railway power purposes either directly in case of direct-current traction or by the installation of separate generators and motor generator tie-in sets, or frequency changers in the case of the alternating-current traction.

COSTS.

The investigation of the Chicago Association of Commerce is probably the best source of information which has appeared to date regarding the details of first and operating costs of electric systems. This report was completed in 1915. It covers a minute investigation of a great railway problem within a compact area of 428 square miles in and around a very large city. Within this area thirty-nine different railway companies operate dense passenger, goods and shunting services over a network of tracks comprising an aggregate mileage of 4500. The net first cost of the equipment required to operate this entire system electrically was estimated and analysed with great care for three different systems and gave the following results:—Direct current, 600 volts, third rail, 188,132,314 dols.; direct current, 2400 volts, overhead, 181,891,122 dols.; single-phase alternating current, 11,000 volts, overhead, 178,127,230 dols. In other words, the first cost was substantially the same for all three systems. This conclusion is, of course, for short-haul conditions; for long-distance haulage the showing for the high-tension system, as compared with the third rail, would be better. For average

conditions estimates I have made on important projects indicate a first cost difference of 15 to 20 per cent. in favour of the high-tension overhead alternating-current or direct-current trolley systems as compared with the direct-current third rail, and of the two high-tension systems the alternating current appears in every case to cost less than direct current.

As to operating costs, the Chicago report showed, *for items affected*, a substantial saving per train mile as compared with steam. The saving was least in case of the 600-volt third-rail system and greatest for the 11,000-volt alternating-current system, but there was not a very great difference between the latter and the 2400-volt "overhead" system. The conditions, however, in the Chicago district are somewhat peculiar; for the average railway condition, estimates indicate differences of 10 to 16 per cent. in favour of the high-tension trolley systems as compared with the 600-volt direct-current third rail and the high-tension alternating current appears in every case to be more economical than the high-tension direct current.

SELECTION OF SYSTEM.

The important considerations governing the selection of a system are:—

(1) Adaptability to all physical conditions of the railways.

(2) Economy in first and operating costs.

(3) Flexibility as regards conducting varying kinds and volumes of traffic.

(4) Suitability for extension.

(5) Possibilities as regards future advance in the art and improvements in details.

I would work, as far as consistent with the above, towards the elimination of systems which are applicable to special cases only. This, as before indicated, would narrow the selection to the adoption of one of the high-tension overhead conductor systems.

The 600-volt third-rail direct-current system would only be considered for extensions to existing installations or for very special cases.

The 1500-volt direct-current system could only be adopted with an overhead conductor and for light traffic requirements; 1500-volt third rail cannot be used generally because of its danger to life. The 1500-volt system is an interim development only. Higher voltage direct-current systems, such as the 3000-volt system, have promise for the future and their development should be allowed to continue unhampered.

The 11,000-volt alternating-current system likewise has a broad field of usefulness and promises well for future development.

The selection, therefore, of a proper system for general use appears to lie between the 3000-volt direct current and the 11,000-volt alternating current. I have referred to the existing difference of opinion as to these two systems, and since I am not recommending the elimination of either from adoption at present, it is unnecessary for me to indicate my preference. I should approach any concrete problem upon its merits along the lines laid down, having regard to the latest experience and facts as to the state of the art when decision is to be made.

FRENCH AND BRITISH REPORTS.

I have looked through the voluminous report of the French Commission on Electric Traction, and, frankly, its conclusions do not seem to be well founded on the data presented. Perhaps the Commission has arrived at a correct conclusion, having regard to the particular conditions in France, but the reasons given for condemning the single-phase system seem inadequate and largely the results of a "scare" as regards the inductive interference question. The Commission seems to have been dominated by telephone and telegraph experts. It also seems to have been greatly influenced by reports of the high cost of maintenance of the alternating current, which, they state, is at least double that of direct current, a conclusion which is absurd. No effort seems to have been made to equate operating conditions in comparing systems, and I doubt if the Commission really had any accurate figures of cost of maintenance of the alternating current. It does not seem to have attached much importance to the future trend of development and possibilities in connection with both alternating-current and direct-current traction.

I was interested, and disappointed, in reading the Interim Report of the Advisory Committee on Electrification of Railways. It would be valuable to know what reasons led the Committee to the adoption of the 1500-volt direct current as standard. I think a mistake has been made, even if it should prove to be the eventual system, because the adoption of any standard now is going to put the development of electric traction in a straight jacket. The development of both the alternating-current and the direct-current systems should continue in order to get the best results finally from electric traction.

STANDING COMMITTEE B, which has been dealing with the larger portion of the Railways Bill, completed its work on Tuesday, the 19th, and Standing Committee A, which has been considering Part III.—Railway Rates—finished its work on Thursday, the 21st. The Bill reached the report stage on Wednesday evening last.

The London Electricity Supply Problem.

No. VII.*

THE inquiry is now nearing its close. Reference was made last week to the evidence of Mr. C. H. Merz, the promoter of the first electric power scheme for London in 1905, who gave evidence on behalf of the County of London Electric Supply Company, which is anxious to erect a power station at Barking. In its initial stages that power station would have an installed capacity of 100,000 kilowatts, although the site is capable of holding up to 600,000 kilowatts. Much is being made of this latter fact by the opponents of the County of London Company, but the company assures the Commissioners that it has no plans in hand for anything beyond the first 100,000 kilowatts. Mr. Merz's views on the best way to develop electric power supply, not only in London, but in all large industrial areas, are now well known, but he enlarged upon them to the Commissioners at their special request. Indeed, it was solely upon the policy of erecting large capital stations at once, in comparison with that of linking up and extending the existing small power stations and postponing the erection of capital stations for something like ten years, that Mr. Merz directed his evidence.

Since Mr. Merz was before them on Tuesday last week, the Commissioners had an opportunity of examining specifications and tenders for 15,000 to 20,000-kilowatt sets running at 3000 revolutions per minute at 50 frequency in relation to the figure of £3 per kilowatt quoted by Mr. Merz. The result was that the Commissioners expressed themselves satisfied that British manufacturers had quoted, in competition and *bond fide*, that sum for these sets for export, without erection or condensers and auxiliaries. According to these tenders, 10 per cent. is added if the order is a home one, and further small percentages for erection, auxiliaries and so on, bringing the price up to £4.55 per kilowatt of maximum continuous rating. If a periodicity of 25 is adopted instead of 50, then a further 10 per cent. is added, making £5 per kilowatt; whilst if the speed is reduced to 1500 revolutions per minute instead of 3000 revolutions per minute, the price is increased to £5.75 per kilowatt. The nearest approach to these figures, quoted in the inquiry, is over £7 per kilowatt, which was mentioned by Mr. Kennedy for the scheme promoted by the nine West End companies.

A development during the past few days is that the County of London Company has now expressed its willingness to co-operate in the working of a Joint Electricity Authority, more or less on the understanding that the Barking power station is authorised without waiting for the Authority to be constituted or the scheme for London to be completed. It is also willing to enter into some such arrangement for selling its power stations to the Joint Authority by lease, as that suggested by the nine companies. Already, it should be mentioned, the company has told the Commissioners that if the Barking power station is sanctioned, it is willing for it to be taken over by the Joint Authority within seven years of the constitution of the latter, on terms to be laid down by the Commissioners. The agreement to come into the leasing scheme relates to the two London power stations of the company which are purchasable by the London County Council in 1931.

Following the evidence of Mr. Merz and Mr. C. P. Sparks, for the County of London Company, the latter of whom stated that the company has had to shut down its sales department because it cannot deal with more business without new plant, the Commissioners called for evidence from the Electrical Trades Union, which represents the rank and file of workers in the industry, and also from the Electrical Power Engineers' Association, which is the trade union of the technical assistants. Both these unions ask for representation on any Joint Authority that may be formed. It is understood that the London County Council favours the representation of labour on the Joint Authority. The technical assistants suggest that if they were given representation they might be able to give the Joint Authority advice, although it was pointed out that the chief engineers would be there. The representative of the Electrical Trades Union made the fantastic suggestion that out of an Authority of twenty-eight, his union should have a representation of fourteen! Provision seems only to be made for one representative, to include both unions, but they will not have joint representation.

During the course of some of the speeches for those objectors who desire to be left out of any schemes, such as the North Metropolitan Electric Power Company and the Metropolitan Electric Supply Company, which has a large power area in Middlesex, it was urged that as the promoters of the London County Council scheme and the scheme of the Conference of Local Authorities had not shown any benefit to the power companies by bringing them in, the case fell to the ground, and it was not for the power companies to show that there would be no benefit. The chairman of the Commissioners held that the matter must be looked at rather more broadly than that, and the whole interests of London and its surroundings must be taken into account.

* No. VI. appeared July 22nd.

The reply was that these objectors did not wish to remain outside any scheme for improving the conditions of electric supply in London and Greater London, but that they were content to work under the jurisdiction of the Commissioners without the intervention and expense involved by the setting up of a Joint Authority. It was shown that under the London County Council scheme both the power companies mentioned would have to contribute towards the administrative expenses of the Joint Authority in proportion to their units sold without any prospect of being able to buy cheap current from the Authority for many years to come. That had been admitted by the engineering witnesses, who also said that *qua* engineering, the areas of these two companies were not essential.

The railway companies have also now addressed the Commissioners in the capacity of objectors, but their position has been entirely altered. They wish to be left a perfectly free hand to do what they think best for themselves, subject, of course, to the sanction of the Commissioners, when they are ready with their schemes. Beyond that, they express a desire to assist the Commissioners in every possible way.

Literature.

The Merchant Navy. Vol. I. By ARCHIBALD HURD. Section of the Official History of the War. Published by John Murray, London, at £1 1s. net.

ONE opens this book with something of a kindly bias, for during the war Mr. Archibald Hurd did two signal services to the British people. For one thing he was able by his writings in the *Daily Telegraph* and other papers to make the Navy live to a large section of the community, which would otherwise have passed it over as something far too technical for them ever to master. For another, he realised the importance of the merchant ship in war at a very early date, and hammered away at the necessity of keeping that importance in view when such tenets were distinctly unpopular.

It is no light task to write a war history of the mercantile marine without poaching on the preserves of Sir Julian Corbett, who is covering the naval war at sea, and Mr. C. E. Fayle, who looks after the economic side, and yet avoid it becoming a dry-as-dust record of facts. One of Mr. Hurd's excellent devices to steer clear of this defect is to quote at length the actual reports which show the impressions, at the time, of the men who were doing things. Not only is the plan very successful in its purpose of promoting the living interest of the narrative, but such reports are, and will be still more, of the very greatest historical value—when they are edited. As an example, the book is designed as a popular history, and in quoting the writings of a passenger, the author makes the cruiser Karlsruhe steam 28 knots, and mentions her alleged ability to do 30. Mr. Hurd knows perfectly well that she could not manage anything like that speed, and a footnote would have corrected the impression in the minds of his lay readers. But the footnote does not appear. Similar criticism is earned by several other passages. Another point strikes the reader: one of the first questions which will be asked by the tyro in the study of the relationship between the fighting and carrying navies is, How were the German merchant cruisers armed, and with what guns? The author mentions that the liner Kronprinz Wilhelm drew her weapons from the cruiser Karlsruhe, but does not say what they were, although this information must be in the possession of the Admiralty. He later quotes a reference to 12-pdr. guns, though they did not exist in the German Navy, and the Karlsruhe did not mount any of the weight nearest to them. Again, only a matter of footnote and pains.

The author very carefully steers clear of any sort of technicalities or technical terms. One of the few times he indulges in them is in reporting the escape of the Southport, a passage which will not particularly please marine engineers. The men of the merchant service are rightly jealous of the wonderful reputation they have won for themselves against so much opposition. They will, we fear, not understand why the author does not concede to the masters of British ships the courtesy title of "Captain." Had Mr. Hurd realised that his adherence to the old formula—"Steamer X, Master Mr. Y"—gives to his appreciation an air of, shall we say, condescension, he would surely have broken away from it.

These are but small faults, and the book is a very valuable contribution to the literature of the war. The author has had access to unlimited material, and has made good use of his privilege. Generally speaking, the greatest care has been taken in the verification of incident, though some of the reports should never have been included. He has taken the greatest possible pains to give the strictest justice to the enemy. The chapters on the auxiliary patrols are excellent, and much of the credit is generously given to Lieut.-Commander E. Keble Chatterton. They are perhaps the best work which Mr. Hurd has turned out, and might have been even better had he been allowed to put them down in his own style instead of being tramelled as every junior public servant must be. The advantages of a writer who has lived the life which he describes are obvious—when the man of action can write as Mr. Hurd can.

A Mechanical Reversing Drive for Planing Machines.

FOR a number of years past there has been a growing tendency to adopt an electrical reversing drive for planing machines, and, as our readers are fully aware, various forms of such drive have been advanced and adopted. It is so commonly assumed that the replacement of mechanical by electrical means for any purpose must essentially be in the direction of progress, that it may appear to some to be in the nature of a retrograde step to suggest a return to a mechanical reversing drive for planing machines. Yet, as we shall show immediately, one firm at least—and an electrical firm to boot—after experimenting with a purely electrical drive and evolving subsequently a form, the essential element of which was a magnetic reversing clutch, has discarded electricity and adopted a purely mechanical drive, or at least one that is purely mechanical in its vital features. It is true that the arrangement in question—as illustrated and described herewith—is connected to an electric motor, and that if this motor is of the variable speed type, additional advantages are secured. It is further true that the application of the brakes, whereby the reversal of the table motion is automatically secured is controlled electrically. But it is to be observed that the arrangement could be quite satisfactorily operated by means of a belt drive instead of an electric motor, while the brakes could conceivably be controlled by mechanical means instead of by solenoids.

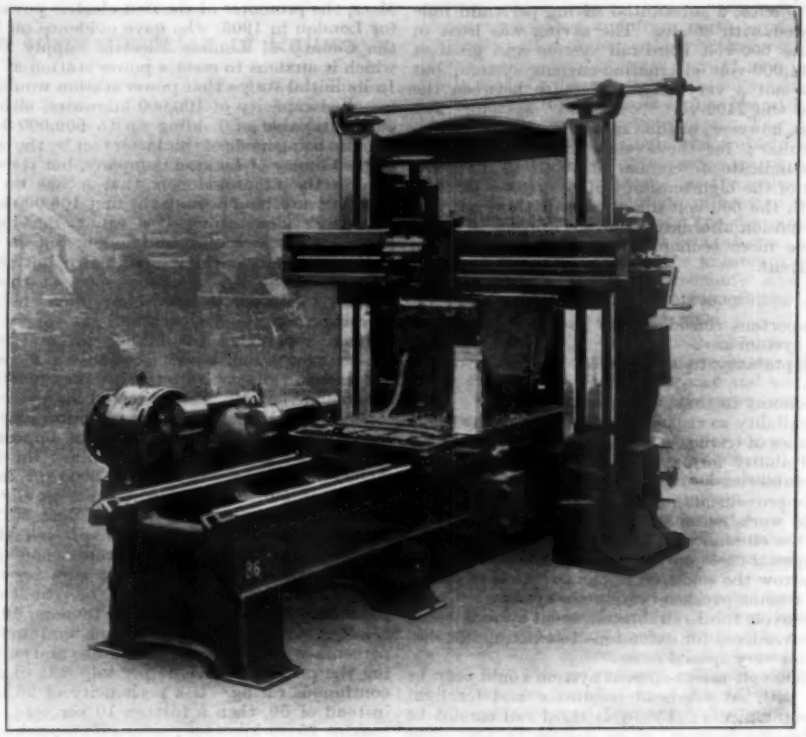
The arrangement in view is known as the "Newton Derby patented reversing drive," and has been designed and developed by Newton Brothers, Limited, of Derby. At this point it should be explained that while the drive is here shown and described as applied to a planing machine, it is applicable, the firm claims, for many other purposes, such as the driving of winches and colliery haulage gears. For our own part, we should like to make it clear that in what follows the arguments employed are Messrs. Newton's and not ours. This remark is not, however, to be taken as implying that we disagree with them on any point, although we are aware that others may possibly be inclined to do so.

Over fifteen years ago Messrs. Newton began experiments on the driving of planing machines. At first they adopted the plan of coupling a reversing motor through gearing to the planing machine table, and then turned their attention to a magnetic reversing clutch. This clutch was built in various sizes, and was successfully applied to the driving of planing machines, gun lathes, &c. The reason for abandoning the reversing motor drive was two-fold. In the first place, it was considered extravagant in power consumption. Secondly, it was comparatively slow in action. Experiments showed that the acceleration, deceleration and reversal of the rapidly rotating and heavy armatures involved, by virtue of the inertia effects, a considerable waste of power, as well as placing a limit on the minimum time within which one cycle of the machine could be completed. The critical fact revealed was that the kinetic energy of the motor armature at normal speeds was nine times as great as that of a machine table weighing with the job on it 40 tons.

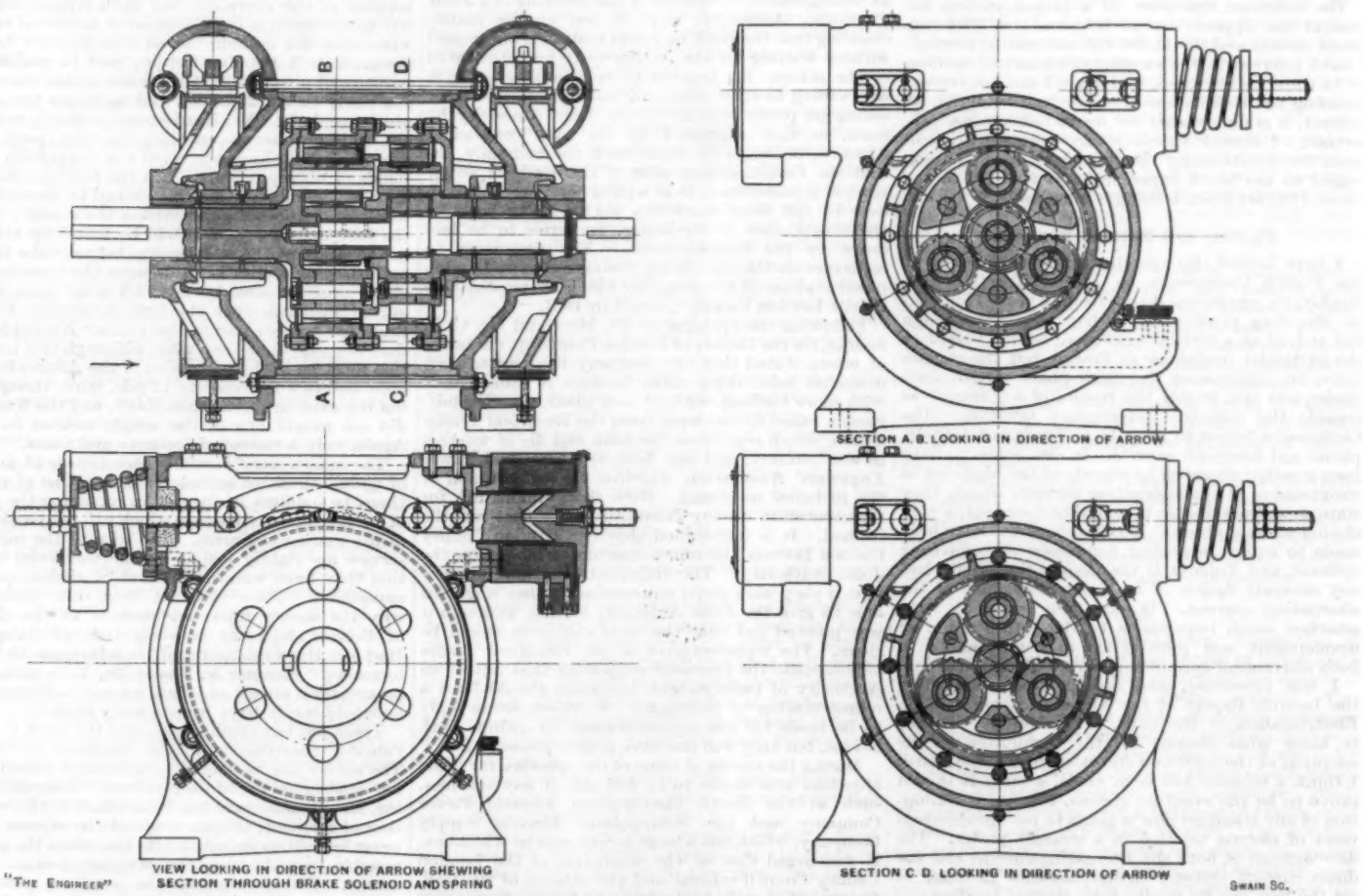
The firm, of course, studied the question of regeneration—that is to say, the system whereby the mechanical energy in the system during the periods of deceleration is used to drive the motor as a generator, the current from which, after passing through the motor generator set usually associated with a reversing motor, is returned to the mains. By these means an electrical braking effect is obtained, and some at least of the energy to be absorbed during the braking period is recovered. Messrs. Newton, however, discarded this line of procedure by reason of the grave complications in the switchgear and wiring systems that were entailed, and also because the amount of energy salved even under conditions artificially made as favourable as possible was found to be negligible. In the latter connection, the initial supply of mechanical energy in the table was depreciated by virtue of the inefficiency of the table gearing, while what remained of it, together with the mechanical energy in the rotating armature of the reversing motor, had to suffer further loss by virtue of the inefficiency of the three electrical machines through which it had to pass before reaching the mains.

The next development, as we have said above, was the magnetic reversing clutch. This device met with a measure of success in the matters of reducing the power input and the limit of time required per cycle. It was found that in this case the kinetic energy of the revolving clutch armature was five times as great at normal speeds as that of a 40-ton table and job, so that in this respect a saving of about 45 per cent. was achieved as compared with the reversing motor system. In addition, there was the further advantage that the single motor drive, as compared with the reversing motor and motor generator drive, avoided two changes of energy—from mechanical to electrical and from electrical to mechanical—and thus saved some 25 per cent. in the power required to drive the mechanism.

Research was, however, continued, with the result that the firm has now evolved a purely mechanical drive, for which it is claimed that the input of power from the mains is lower and the speed of reversal is greater than have ever been attained before. Whether or no our readers will agree with this assertion, they will, we think, join



PLANING MACHINE FITTED WITH THE NEWTON-DERBY REVERSING DRIVE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SECTION A. B. LOOKING IN DIRECTION OF ARROW
"THE ENGINEER"
VIEW LOOKING IN DIRECTION OF ARROW SHEWING SECTION THROUGH BRAKE SOLENOID AND SPRING
SECTION C. D. LOOKING IN DIRECTION OF ARROW
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THE NEWTON-DERBY REVERSING DRIVE MECHANISM

with us in saying that, as a piece of mechanism, Messrs. Newton's new gear is a very neat piece of design, although in principle it is more or less familiar to motor car engineers and others.

The general arrangement of the new drive is illustrated on p. 124, but its principle of action will be more readily followed from the diagram given below. The drive in the case illustrated is operated by a direct-current variable-speed motor, constantly running in one direction, and consists of a form of epicyclic gearing interposed between the motor spindle and the main pinion shaft of the planing machine. The shaft A of the drive is directly coupled to the motor spindle, and carries at its end a sun pinion B, which meshes with three planet pinions C. These planet pinions are journalled on a cage D, free to rotate on the shaft A and formed with a brake drum E. The cage, further, carries a second sun pinion F, which meshes with three planet pinions G, journalled on a second cage H, the shaft of which is directly coupled to the table shaft. Mounted to rotate on the shaft of the cage H is a muff J, provided with a second brake drum K, and formed internally with two circular racks with which the two sets of planet pinions C and G engage. Brake straps surround the drums E K, and are operated by means of solenoids and springs.

The solenoids are energised as required by means of a reversing switch operated automatically by adjustable dogs on the planer table. If neither is energised and the motor is running, the gear runs idly without moving the table. During the cutting stroke, however, the drum K

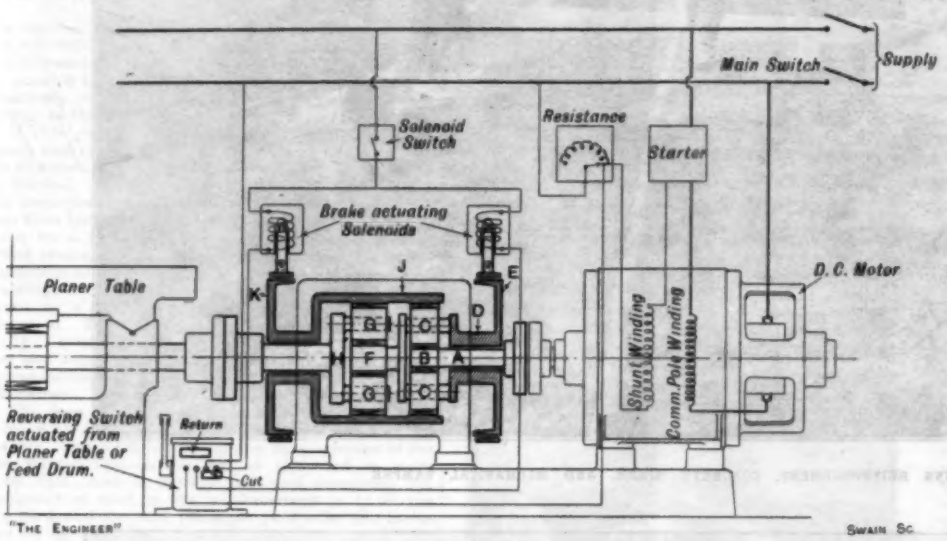


DIAGRAM OF THE NEWTON-DERBY REVERSING DRIVE

is held stationary by the action of its solenoid and brake. As a consequence, the pinion B rotates the pinions C, which move round on their rack inside the fixed muff J, and therefore impart motion to the cage D and pinion F. From the latter pinion motion is imparted to the planets G, which, moving round inside the fixed muff, produce rotation of the cage H, and therefore of the planer table shaft.

On the return stroke, the drum K is released, and the drum E instead is held stationary by the solenoid and brake associated with it. In these circumstances the pinion B and planets C impart motion to the muff J, while the pinion F remains stationary with the cage D. As a consequence, the rotating muff moves the planets G round the fixed pinion F, and so causes the rotation of the cage H and the table shaft. Under the second set of conditions, the table shaft, as is required, rotates in the reverse direction, and at an increased speed—four to six times as great—as compared with its rotation under the first set. The features of the design are the neatness and compactness with which the whole gear is assembled within its casing, and the fact that the change from the cutting to the return stroke does not involve the reversal of the direction of rotation of any of the gear members. Moreover, the inertia of the rotating portions is very low. At normal speeds the kinetic energy stored in the drive is, Messrs. Newton inform us, only one-tenth of that stored in a 40-ton table and job, as compared with nine times and five times respectively in the cases of the reversing motor and magnetic clutch drives previously referred to.

If a constant-speed alternating-current motor is used to drive the gear, the cutting and return strokes of the table are constant at the values determined by the design of the gear. Three sizes of the gear are made, the smallest being suitable for planers up to 3ft. in size, the intermediate for 3ft. to 5ft. planers, and the largest for planers of 4ft. and over. With a constant speed motor these three sizes give, respectively, return to cutting speed ratios of 4, 4.85 and 4.24 to 1. With a variable-speed direct-current motor, the cutting speed is not constant, but can be varied by means of a resistance inserted in the shunt winding of the motor. This resistance is connected mechanically to the table in such a way as to be automatically operated at the beginning and end of the return stroke. Whatever cutting speed is chosen by the attendant, the resistance is automatically operated at the beginning of the return stroke to give the full return speed and at the end of the return stroke to restore the chosen cutting speed. The three sizes of gear under this condition give ratios of return speed to lowest cutting speed of 4.56, 5.15 and 6 to 1.

It is unnecessary to summarise further the claims made for this drive by its makers. By way of illustrating its capabilities, however, we may call attention to the sample of planed work shown standing on the table of the machine in the half-tone engraving. The ten or so cuts on the sample were taken at 60ft. per minute, yet so well defined is the termination of the cutting stroke that no one tool mark is $^1/_{16}$in. longer or shorter than the mean.

Tin Mining in Malaya.

LAST year's export of tin from the Federated Malay States amounted to 34,935 tons, valued at £10,816,737, compared with 36,935 tons in 1919, valued at £8,736,474. In 1918, the exports amounted to 37,370 tons. In his annual report, Mr. A. R. Mynott, Acting Senior Warden of Mines, states that at the opening of the year the price of tin on the local market was 167.50 dols. per pikul,* with the market rising. The rise continued rapidly until at the end of February the unprecedentedly high price of 212 dols. was reached. Thereafter a reaction set in, and the price began to decline. With the exception of a slight rally about the middle of the year, the fall in price continued until, at the beginning of December, it stood at 90 dols. per pikul. The position at that time became so critical that to save a large number of the mines from closing down, and the consequent dislocation of labour that would ensue, the Government decided to purchase. From December 14th, the Government was purchasing at 110 dols. per pikul, which price was raised on December 21st to 115 dols., and that was the position at the close of the year. The highest price reached was 46 dols. per pikul above that attained in 1919, and the lowest price touched was 10 dols. below the similar figure for the previous year. The fluctuation was 122 dols. in the year under review as compared with 66 dols. in 1919.

On the London market, the highest three months price reached was £423 10s. per ton, and the lowest £200. From March onwards, a rapid decline in price was experienced, the market eventually collapsing towards the end of the year, the average price for the year being £297 5s. 11d. The extraordinarily rapid rise in the price at the beginning of the year was due chiefly to the operations of speculators, and the reckless buying was no doubt due to the erroneous deduction that a falling off in production was anticipated, with consequent reduction of supplies, that the Central European Powers would be in a position to assimilate amounts approximating their pre-war requirements, and that consumption in the United Kingdom and America would increase. The slump at the end of the year was due to a variety of causes, chief amongst which was the reduced consumption demand, the unexpected unloading of stocks of Dutch tin on the London market, the liquidation of large stocks of Chinese tin which had been held up in Chinese ports owing to the high price of silver at the beginning of 1920, the disorganisation of the Welsh tin-plate industry towards the end of the year, the instability of exchange, and the general labour unrest. The outlook at the end of the year was not encouraging; general conditions were bad, and no improvement in the market could be anticipated whilst the depressing influences mentioned above were in evidence.

The following table shows the actual export of production in each State for the last three years:—

	1918. Pikuls.	1919. Pikuls.	1920. Pikuls.
Perak	387,750	371,722	371,848
Selangor	170,359	178,608	148,715
Negri Sembilan	16,246	14,761	11,710
Pahang	53,460	55,427	54,632
Tota.	627,815	620,518	586,905

LABOUR.

The labour force employed on mining at the end of the year (inclusive of invividual licences, but exclusive of holders of dulang passes) was 89,557, all of whom, with the exception of 610 on gold and 3000 on coal, were employed on tin and tungsten mining. The numbers in 1919 were 113,107, and in 1918, 144,621. The labour force is the lowest recorded for twenty-one years. There were 12,867 dulang pass holders in 1920 compared with 15,553 in 1919, and 15,774 in 1918. Dulang pass holders in the three Western States earned on an average 251 dols. per head, an increase of 54 dols. per head over 1919.

There were 26,096 employed under contract, 37,908 on wages, 24,941 on tribute, and 612 held individual licences. The nationality of those employed was as follows:—Europeans, 274; Chinese, 82,811; Indians, 4489; Malays, 1907; and others, 79. There was a decrease in Chinese of 22 per cent. as compared with 1919.

MACHINERY.

The total effective horse-power of the various mechanical plants employed on mines, including the gold mines at Raub and the colliery at Rawang, is estimated at 64,360. It was made up as follows, the figures for 1919 being given for the sake of comparison:—

	1919.	1920.
Steam	25,826	29,889
Steam-electric	2,771	3,652
Hydraulic	17,497	18,859
Hydro-electric	4,686	4,637
Suction gas	1,811	1,993
Oil engines	2,552	3,730
Oil-electric	2,200	1,600
Total	57,343	64,360

Plant was not so difficult to get as had been the case in preceding years, but was still enhanced in price. The use of gravel pumps is on the increase, and very few open-casts in Perak are now worked by old-fashioned methods. There were twenty bucket dredgers operating, eighteen of them in Perak. The bucket dredgers proposed and under construction amounted to thirty-two at the end of the year. The total acreage alienated for tin-mining, exclusive of unsurveyed concessions, was 235,236 in 1920, 242,962 in 1919, and 238,511 in 1918.

It is interesting to note the change that is occurring in the fuel supply following on the mining of Malayan coal. The consumption of coal, oil and wood in tons in the three years 1918, 1919, 1920 was, as nearly as can be ascertained:—

	1918.	1919.	1920.
Coal	86,290	88,839	102,270
Oil	3,488	3,397	2,702
Wood	741,357	708,363	769,790

The number of prospecting licences issued during the year was 146 against 135 in 1919, and the area selected 6006 acres against 3793 in 1919.

GENERAL.

In the closing remarks of his report, Mr. Mynott states that mining costs were very high at the beginning of the year, but that the slump at the end of the year made it necessary for miners to consider how best to lower the cost of production, with the result that wages were considerably reduced by, in some cases, as much as 20 to 25 per cent., and it is to be remarked to the credit of those concerned that the situation was accepted without trouble. Approximately, 64 per cent. of the mines were under Chinese management compared with 68 in 1919. In 1913 this percentage was 74.

The prosperity occasioned by the high price of tin at the beginning of the year resulted in higher wages, and the price of foodstuffs and stores rose in like manner, so that when the slump came at the end of the year the difficulties before the miner who had not the advantages of cheap power and who had not built up reserve funds were great. The action of the Government in purchasing tin at the end of the year undoubtedly saved many of the smaller mines from closing down, but the slump showed the necessity for miners to store up reserve funds in times of prosperity for use in times of emergency.

* 1 pikul = 133 lb.; 1 S.S. dollar at fixed rating = 2s. 4d.

ENGINEERING IN MEXICO.

THE Mexican Government has given permission for two important engineering projects to be proceeded with, the first being a central terminus in the capital to take the place of the three or four widely-separated railway stations in Mexico city, and the second the construction of a commodious pier and wharf at Vera Cruz, the principal port in the Republic. As regards the new terminus, no time limit has been set for the commencement or completion of the work, nor have the specifications as yet received the official approval of the Ministry of Railways. It is known, however, that the total costs will run into several millions of pesos. While the Government will bear the greater part of the outlay necessary, owing to its preponderating interest in railway improvements and holdings of railway stocks, part of the expense will fall upon the Mexican railway companies having their termini in the city.

On the other hand, the cost of the Vera Cruz pier and wharf will be entirely a private affair. The concession granted covers an operating period of twenty years, after which it will pass to the ownership of the Government. The length of the pier will be 400 m. and the width 100 m., the constructional material being of stone and reinforced concrete. The warehouses and shelters, adequate for the handling of the continually increasing quantities of merchandise entering the port, will accommodate seven ordinary vessels at the same time. The latest and most approved loading and unloading apparatus will be installed, including automatic carriers. The first half of the wharf is expected to be completed and put to commercial use within two years from this date. Four railways run out of the town, two being trunk lines to the capital, one a short line to Alvarado, and the fourth running to the Isthmus of Tehuantepec.

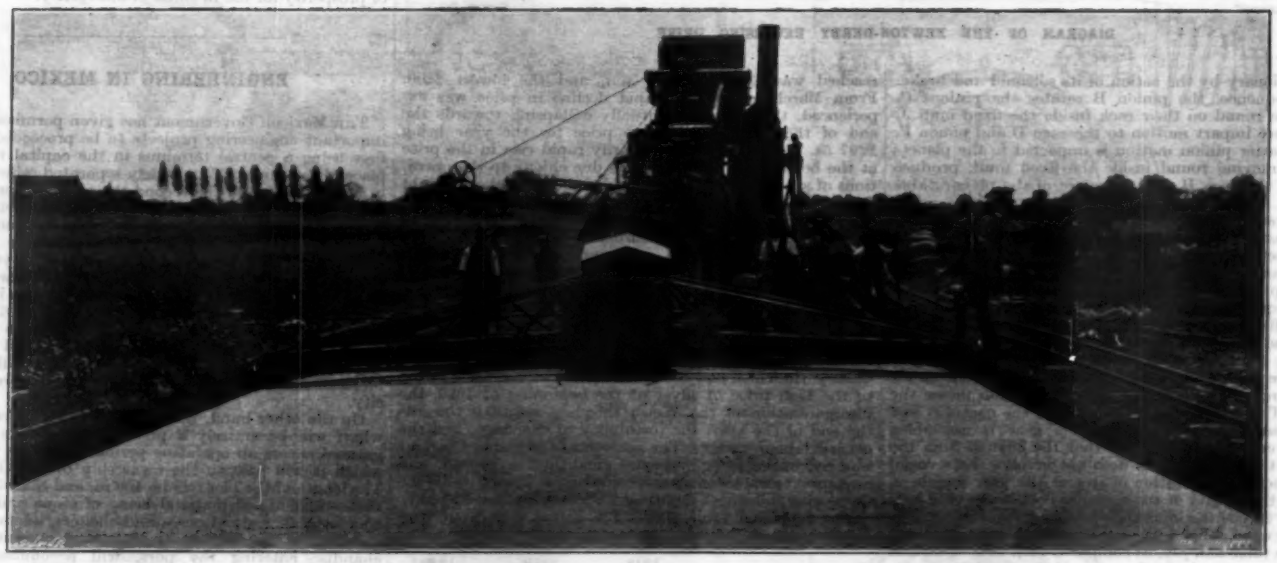
ON May 23rd, at 10.55 p.m., a slight collision occurred in the Victoria Station, Manchester, of the Lancashire and Yorkshire Railway Company. Some empty carriages were standing at the outgoing end of No. 23 road. The platform signal-box signals should have protected them, but owing to the coal stoppage the box had been closed at 10 p.m., and the signals lowered. The train was admitted into the station by a caution signal given by the box there, and the driver proceeded with care until he saw the platform box signal "off," when he went ahead and caused the collision. Notification of the earlier closing of the box had been given by a typewritten circular of many pages. But Major Mount, in his report, just issued, on the collision, said, "This circular, however, had not been brought to the notice of drivers." The company now proposes to track-circuit this and the other through platform lines, remove the platform signal-box and its signals, and provide illuminated diagrams in the two boxes at the ends of the station.

A REINFORCED CONCRETE ROAD AT WILLESDEN

MR. P. WILKINSON, M. INST. C.E., LONDON, ENGINEER.

(*For description see opposite page.*)

VIEW SHOWING REINFORCEMENT, CONCRETE MIXER, AND MECHANICAL TAMPER



THE CONCRETE SURFACE BEING FINISHED BY MECHANICAL TAMPER

THE COMPLETED ROAD COVERED WITH SOIL

A Reinforced Concrete Road.

A LENGTH of road which forms a section of one of the arterial roads now being constructed by the Middlesex County Council, in conjunction with the Ministry of Transport, by means of unemployed labour, is being made of reinforced concrete. The route of which it forms a part commences at the proposed junction of the new Great West-road now under construction with the existing Bath road in Chiswick High-road. The route first takes a northerly direction by way of Gunnersbury-lane, passes through Ealing by way of Hanger Hill, across by Park Royal to the Harrow-road, through the disused Willesden sewage farm, which is the portion of the road with which we are specially concerned in the present instance; then proceeds in a north-westerly direction, passing just south of the Welsh Harp reservoir, crosses the Edgware-road, and, passing along just south of the Brent for some distance, reaches the Regent's Park-road in Finchley. From thence, by way of the Regent's Park-road, Woodhouse-lane, and Bowes-road, it reaches Green-lanes in Southgate by the Cock Inn. From this point a new road is cut through to Weir Hall, Edmonton, and Silver-street and Angel-road are there utilised and widened as far as the river Lea, forming the Essex County boundary, from whence the Essex County Council takes up the work. The main object of this arterial road is to give the eastern counties a route round the north of London and so relieve congestion at the centre. The total length of the route in Middlesex is 12¼ miles, of which 7¼ miles will be entirely new.

The lay-out of the new road is 100ft. wide between fences, the width being divided as follows:—16ft. on either side is devoted to footpaths; the centre 20ft. is reserved for a possible high-speed tramway on a sleeper track, or, alternatively, possibly for a special track for heavy vehicles, according to the trend of traffic developments. On either side of this centre track 24ft. carriageways are being planned, and it is one of them which forms the subject of the illustrations on page 126 and which is described in what follows.

The road traverses ground which was formerly once sewage filter beds, and does not, therefore, offer a desirable location for a road from the foundation point of view. For that reason it was considered necessary to construct a foundation of a character affording a maximum degree of stability, and it was thought that that could best be obtained by a heavily reinforced concrete slab form of construction. The slab is 8in. thick, the lower 5in. being of 5 : 2½ : 1 concrete and the top 3in. of 3 : 1 : 1. All the ballast and sand is washed and forms a good aggregate. The reinforcement is that known as the "Walker-Weston Reinforcement," which consists of a double-layer framework 5in. deep, made up of $^{9}/_{10}$in. top and bottom bars with No. 6 s.w.g. annealed mild steel wires connecting the two layers. The mesh is put together by employees of the Walker-Weston firm on the site of the road in mats 24ft. by 6½ft., and is quickly laid and connected up. The amount of steel in the reinforcement is 10 lb. per square yard, and the price per super yard is 3s. 8d., inclusive of laying and laps.

The concrete mixer is of the Lakewood pattern, and deals with a batch of 21 cubic feet of dry aggregate, producing about 14 cubic feet of concrete. It is operated by one man and can turn out a completely mixed batch in 2 min. The feeding is effected by means of Decauville trucks which run on rails at the side of the road, the trucks being lifted and tipped into the feeding hopper by means of a swinging arm operated from the machine.

When the full depth of the concrete has been deposited it is finally levelled and consolidated by a petrol-driven mechanical tamper, which is fitted with a cambered screeding beam followed by a cambered tamping beam which gives a 3-ton blow and consolidates and faces up the concrete. The tamping machine runs on bulb-headed rails standing on an 8in. flange. The concrete when laid is kept covered for at least three weeks with soil, which is kept moist to enable the concrete to be thoroughly cured and set. The soil is then removed, and before the road surface is exposed to traffic it will be tarred and gritted. It is fully expected that with nothing further done to it the road surface will satisfactorily withstand the traffic likely to come upon it, but the precaution has been taken of so setting out the levels that an additional surface may be superimposed if and when it becomes necessary.

The carriageway will be bordered by *in situ* reinforced concrete kerb 12in. deep and 8in. wide, the reinforcement being of strips of expanded metal with felt expansion joints at about 20ft. intervals. There are no expansion joints provided in the carriageway, it being anticipated that owing to the reinforcement the cracks that will probably arise will be of such a minor character that they will not materially affect the wearing properties of the concrete.

The work is being carried out by unemployed labour, which is quite unskilled in the particular work in hand, and mainly totally unused to navvy work. Moreover, in order to spread relief over as many families as possible, the gang is changed every three weeks, which, however desirable from the relief point of view, is very inimical to economical working. Every change of gang produces a drop in the output of some 30 per cent. for the first few days. The cost of work carried out under such conditions is not of much interest except as a matter of comparison, but it is noteworthy that at present the total cost, allowing for full depreciation on all plant and for supervision expenses, is working out at about 23s. 10d. per super yard, of which 3s. 8d. is applicable to the reinforcement. The ballast and sand is costing about 18s. per ton, and cement 90s. per ton.

The work in the Willesden area is being carried out through the agency of the Willesden Urban District Council by Mr. F. Wilkinson, M. Inst. C.E., the Council's engineer.

LANTERN SLIDES.—We have been advised by Bruce Peebles and Co., Limited, of Edinburgh, that they have a large number of slides dealing with their works and manufactures, which are now available for illustrating lectures on electrical machinery. In addition, they have many slides which deal with self-contained and open type alternating-current and direct-current generators, &c.

The Newcomen Memorial.

IT is now more than sixty years ago since the Dartmouth antiquarian Thomas Lidstone endeavoured to arrange for the erection of a monument to Thomas Newcomen, the pioneer of steam engineering. Mr. Lidstone unhappily did not live to see his hopes fulfilled, but in 1912 the present Mayor of Dartmouth, Mr. Charles Peek, took the matter up, and, with the aid of Mr. Humphreys, the chairman of the Memorial Committee, and of Mr. Caston and Mr. Magenis, who have successively carried out the duties of honorary secretary, the scheme has been brought to a successful conclusion. Dartmouth now possesses a memorial that will recall not only to her inhabitants but to thousands of visitors the name and achievements of her most distinguished son.

The memorial consists of two engraved brass tablets mounted on a large rough-hewn granite block, which has been placed in the public gardens facing the river Dart. One of the tablets contains a few particulars of Newcomen, and in the other is engraved a drawing of the atmospheric steam engine.

Newcomen was born in Dartmouth, and was baptised

NEWCOMEN MEMORIAL AT DARTMOUTH

in St. Saviour's Church, February 29th, 1663. The main facts of his life are contained in a paper read to the Devonshire Association in 1914 and published in their "Transactions." Besides being a blacksmith, Newcomen for a number of years was pastor to the local Baptist church, and strove for religious liberty. The house he lived in was taken down in 1884, but the Memorial Committee hope to place a tablet on the house now occupying the site. The first of Newcomen's engines appears to have been the one erected near Dudley Castle in 1712, while one of the last to be seen at work was at the South Liberty coal mine at Bedminster, near Bristol. This engine was still in use during the 'nineties of last century. Newcomen died in London, August 5th, 1729, and was buried in Bunhill Fields burying ground.

The unveiling of the memorial at Dartmouth was performed by the Mayoress, Mrs. C. Peek, on Thursday, July 21st, and during the ceremony a wreath was placed upon it on behalf of the Newcomen Society as a tribute to the memory of the great engineer.

Railway Fuel Economy in Sweden.*

THE best fuel economy will be obtained by the railway which has the best trained men at the regulator and the shovel. There is a difference of at least 10 per cent. in coal consumption between ordinary engine-drivers and firemen, and double that difference between engines that are given good and bad supervision, so that fuel and money will be lost by careless management, even if the engines are provided with the best fuel-conserving apparatus. For example, says Mr. Uddenberg, take a superheater engine that theoretically saves 20 per cent. in coal, and keep account of all the time when there is no superheat at all, or not sufficiently high to save coal, as a result of too much water in the boiler, bad driving or firing or leakage in the superheater, and you will sometimes not find much saving.

On the Swedish Government Railways, he continues, each fireman must attend a six weeks' theoretical course, held by the railway, after which he is examined, and if not approved he cannot be retained as fireman. This course is held some years after he has begun to fire, because it has been considered necessary to have a good deal of practice before entering the course. But, he adds, it is, in his opinion, a mistake to let a man practise firing for some years, and then require him to attend a school to learn theoretically to fire. Wrong methods acquired on the locomotive will usually follow him in spite of better knowledge. He considers it better, therefore, to teach the man theoretically before he gets on the engine, and train him first by firing engines, as well as on a cold engine, to handle the shovel, so as to put in the coals on that part of the grate the instructor directs. The art of firing is to place the coal on the nearly uncovered part of the grate, and the first thing is really to learn to discover that place, and secondly to place the coal there. When that is learned, the one-scoop firing comes by itself.

Mr. Uddenberg then goes on to explain that in a metodh of coal control tried on the Swedish Railways during the past year, the coal was measured before being given to the engine, and what remained was measured at the end of the trip. The measurement was reduced to weight by using 0.9 as specific weight. Of course, he remarks, it would be better if the coal were weighed, but that would require a weighing machine on each tender. However, the method proved satisfactory. It showed for each trip the coal used per 1000 ton-kilometre and per train kilometre by each driver, fireman and engine. For each month the figures were compared for each class of train and each group of crews. This control requires that the crews and engines be in groups of five to twelve, and in nearly the same kind of work on the same lines.

A great difference was found to exist between different engines. For example, the record for February, 1921, showed that the class "F" engines in the night passenger service from Stockholm to Hallsberg—about 200 kilom., with trains of 450 tons—have a coal consumption of from 32.80 kilos. to 38.24 kilos. per 1000 ton-kilometre car weight, or a difference of 18 per cent. between engines classed in good condition. On a day train, with only 340 tons, but with frequent stops, the consumption was found to vary from 40.16 kilos. to 48.73 kilos., or a difference of 21 per cent. The coal control records showed, however, that the same engine might be good with one class of train, but poor with other trains. Mr. Uddenberg has found that the supervision of the engines in this way is one of the most important factors for bringing down the coal bill. It requires interested men to make up the records, and interested and skilled engineers to follow the engines and see that they are repaired in the right way, and that in the round-houses attention is paid to the draught arrangement, cleaning of flues and superheater pipes as well as to scale prevention.

As for the draught arrangement, very seldom does the centre line of the exhaust nozzle or blast pipe coincide with that of the funnel, when placed by ordinary methods in the shops. That is now controlled in Sweden by the use of a centring device. To aid fuel economy by good and frequent cleaning of the tubes and superheater pipes, the Swedish railway engineers are using a Superior steam blower, inserted in the fire-box through two stay tubes in the water spaces, one on each side of the fire-box. The nozzle is formed so that the steam is expanded to highest velocity and leaves the nozzle in a fan-shaped jet. By turning the movable part of the apparatus, this jet is made to sweep over the tube field, one-half from each apparatus. Apparently, in spite of the oblique angle of incidence of parts of the jet, all the tubes are cleaned. The advantages of this practice are that the tubes can be kept clean by cleaning them while the engine is in service. At the same time, there is no cooling of the tubes which might result in leakage.

The prevention of scale where only bad water is available requires, remarks Mr. Uddenberg, careful study by chemists. To loosen hard and thick scale from the tubes with chemicals is not to be recommended and rarely gives good results. The only way to prevent the formation of scale seems to be by purifying the water at all water stations or by a daily supply to each engine of a fixed amount of chemicals.† In either case, it is a good practice each day to blow out from the bottom of the boiler from one-tenth to one-sixth of the water. This should be done after the engines have been standing still at least an hour, so that the particles have fallen to the bottom. Besides all this, the water in the boiler ought to be renewed after from six to fifteen days. Each engine that is taken out for repairs for a day or so might be washed out, and washouts may be made at least once or twice in the month. The Cumberland process for boiler preservation has been installed on one of the Swedish engines, but it will be a year or so before definite results will be obtained.

* From a paper by Mr. C. E. Uddenberg, Superintendent of Motive Power of the Government Railways of Sweden, read at the annual convention of the International Railway Fuel Association at Chicago in May, 1921.

† The introduction of chemicals to the boiler is not favoured either in this country or the United States, the best and most logical plan being to treat the raw water and to deliver only treated water to the boilers.

THE climb from Chuyungkwan to Chinglungchiao, on the Peking-Suiyuan railway, so seriously delays trains that it has been decided to purchase some more powerful locomotives, to rebuild about forty bridges, and otherwise improve the line.

READERS of THE ENGINEER will be aware that we have always urged that the privately owned wagon had its rights on the railway. It was in existence for use on tramways, before there were railways, and when the first railways were built the wagons were privately owned. Moreover, railway companies obtained specific powers to compel traders to provide their own wagons for certain traffic. Much has been said about the saving of empty haulage and shunting were all wagons company owned, but it generally is overlooked that coal wagons, whoever they belong to, must return empty from the towns and ports to the pits. In Mr. E. H. Pratt's "British Railways and the Great War"—Selwyn and Blount, Limited—Part VIII., there is a chapter devoted to pooling privately owned wagons. All the old anticipated benefits are reviewed, but the chapter closes with the conclusions of the then Railway Executive Committee that the scheme was impracticable. One statement of Mr. Pratt's must be challenged. He said that the risk of breakdown is greater with privately owned wagons. This cannot be so, if reliance may be placed on the Railway Accident Returns. There are, roughly, 650,000 privately owned wagons to 750,000 railway owned, and yet in 1919—and it was the same in previous years—there were 3288 failures of privately owned wagons out of a total of 8912.

The Stevenson Gear Wheel Shaping Machine.

THE machine illustrated herewith, the Stevenson multiple shaping machine for cutting gear wheels, has recently been developed by the Stevenson Gear Company, of Indianapolis. The essential feature characteristic of the machine is the fact that it cuts all or a large proportion of the teeth simultaneously and not one by one, as is the frequent practice in other machines of the same class.

The principal detail of the machine is the tool head, of which we give a separate illustration, showing the under-

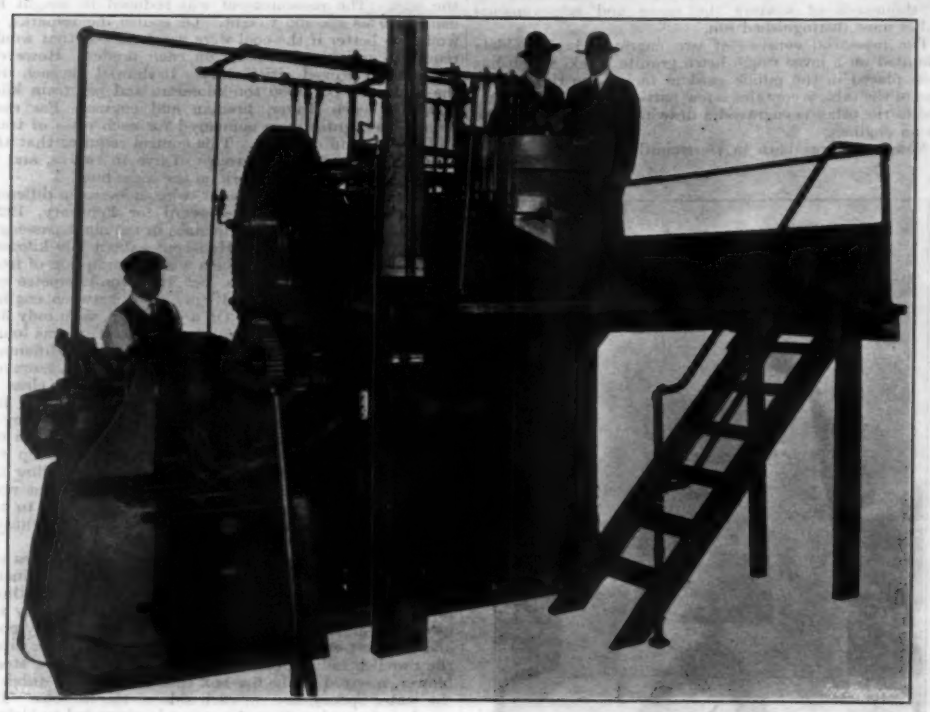


FIG. 1—THE STEVENSON MULTIPLE GEAR SHAPER

side with certain parts removed to make the interior visible. In this example the head is shown equipped with twelve tool bits arranged for cutting a twelve-tooth wheel. The same head with different tool bits could be used for cutting wheels with twenty-four, thirty-six, and other numbers of teeth. For a ten-toothed wheel the head would be equipped with ten bits and could be tooled for a twenty, thirty, or otherwise toothed wheel. As will be explained presently, the machine can be arranged to cut an odd number of teeth without requiring one bit for every tooth.

The wheel blanks—one or more in series—are mounted on an arbor which is inserted in a holder at the end of a vertical power-driven ram. The tool head is fixed over the ram and does not move during the machining of the

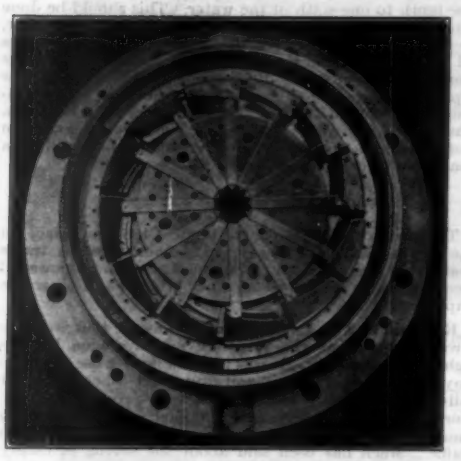


FIG. 2—THE TOOL HEAD

wheels. The cut is taken by the upward movement of the work against the tool bits. At the end of the cutting stroke the tool bits are caused automatically to withdraw to a small extent away from the work in order to provide clearance on the quick-return downward stroke of the ram and work. At the end of the return stroke the work and the arbor are indexed round one pitch distance in the arbor holder at the end of the ram. At the same time the tool bits move inwards to recover the clearance and are advanced beyond their former position to provide the feed. The inward movement of the tool bits for the latter purpose is produced by the rotation of a ring inside the tool head, which ring carries a series of cam blocks, one for each tool. Spiral shoulders on the cam blocks bear against the ends of the tool bits for this purpose. The retraction of the tools to provide clearance is effected by a reverse movement of the cam ring. In order to cause the tools to withdraw they are provided at their outer ends with pins which engage with spiral slots in the cam blocks.

The portion removed from the head in the second engraving consists of a clamping plate, which is given a small rotary and return movement at the end of the return stroke and at the end of the cutting stroke. By this means the tool bits are pressed into their grooves to lock them in position during the cutting stroke and released for retraction and feeding during the return stroke. The tool bits are vee-sectioned and engage with vee-sectioned slots.

When the tools have been fed to the finished depth the feed motion is interrupted, the tools are held steady in their last position, and the work is allowed to rise and fall and index for one more complete revolution. In this way every tool bit is given the chance of cutting a little more off every tooth, with the result that, even although all the tool bits may not be exactly the same or exactly similarly set, all the teeth will be cut to a uniform degree.

The tooling of the head can be carried out in various ways. If the number of teeth is large each slot may be equipped with a tool bar formed with more than one cutting point. Again, the tool bits may be arranged, some to take a roughing and some to take a finishing cut, or with only one finishing tool, which is held back until all the others have brought the teeth almost to the final form. In the case of a wheel with an odd number of teeth, the number of which is too great to permit the use of one tool for each tooth, the arrangement adopted consists of spacing the tools at equal angles with the exception of one. Thus in the case of a twenty-nine-tooth wheel ten tool bits would be used, of which nine would be spaced apart at an angle of $^{9}/_{29} \times 360$ deg., while the tenth tool would lie at an angle of $^{1}/_{29} \times 360$ deg. relatively to the ninth. After the work had indexed twice the cutting of all the teeth would have been begun. The ninth cutter in this arrangement would be called upon to do one-third less work than its fellows.

The claims made for this machine include one for a very great saving of time. Comparative figures have been supplied to us by the makers which indicate that in competition with other gear shapers, hobbers, and millers the cutting time saved by using the Stevenson machine varies from 59 per cent. to 96 per cent. These figures relate, however, not solely to the cutting of gear wheels, but to the machining of such similar articles as sprocket wheels, splined shafts, reamers, milling cutters, and small circular saws. It will be noticed that the saving of time effected covers the actual machining process alone and does not include the time spent on setting up the machine. The re-setting of the tool head and the sharpening of the tools is also not included in the count, apparently, for the reason that two tool heads are supplied with each machine, one of which is being re-tooled while the other is in use.

On the purely mechanical side the makers are perhaps on sounder ground in their claim for increased steadiness of the work under the reaction of the cut. As the cut is taken simultaneously at, in general, equally spaced points all round the circumference of the work there is practically no tendency to deflect the arbor as there is in the case of a machine cutting one tooth at a time. For this reason the top end of the work arbor need not be supported, and as a consequence its withdrawal from the holder and its replacement by a freshly charged arbor can be effected in reduced time.

A SAFETY FOOT VALVE.—We have received from J. Blakeborough and Sons, Limited, of Brighouse, some brief particulars of Key's patented foot valve for centrifugal pumps. The valve itself takes the form of a disc which is pivoted to a lever and guided by trunnions moving in slots in such a manner that it turns edgeways to the stream of water sucked up by the pump. The disc retains this position, even if the flow of water ceases, and thus prevents the piping from being damaged by shock in the event of the pump loosing its water. When it is desired to prime the pump, the valve is brought down on to its seating by means of the lever.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

The Lancashire Drop in Common Iron.

THE Lancashire houses have declared a further reduction of £2 per ton in Crown bars below the £16 which was recently standardised in this district, and Staffordshire consumers are this week pressing local ironmasters to accept the same reduction. That they will have to do so shortly is certain. There is some sharp criticism here at the way in which Lancashire is forcing down prices without consultation with this district or other parts of the kingdom. Belgian nut and bolt iron is now obtainable at £10 per ton delivered here, though no great tonnage appears to have been bought. The consuming nut and bolt works are well stocked and are very poorly employed, so that their immediate requirements are not great. A few merchants have placed orders with local firms for best iron, but business generally is of a hand-to-mouth character, suggesting no strong undercurrent. The marked bar houses have not the usual volume of business, largely on account of the slump in shipbuilding, which usually calls for considerable tonnages of best iron. In most cases, however, they have enough orders on their books to enable them to carry on. Production has been seriously interfered with by the heat, which the men, after the long period of idleness, find extremely trying. Prices remain at £20 per ton basis. Business in iron strip at £20 is held up by the fact that users are meeting their requirements with steel strip, which can be bought at a much cheaper figure. Local steel strip quotations as low as £12 are reported, but even these leave a margin in favour of imported material. As regards finished iron business generally, there has been a more widespread resumption now that coal can be had. The mills and forges are doing a little work with crude and half-finished materials imported from the Continent. A slightly improved export inquiry is reported for galvanised sheets, and for corrugated sheets 24 gauge £23 to £25 is quoted in bundles f.o.b. ports for August and September delivery. Inquiries for sheets in this district encourage the hope that Staffordshire mills will start next month. Some orders have been booked on this basis.

Pig Iron Trade and Belgian Competition.

Making pig iron for sale is not regarded as a practical proposition, and in the Midlands total inactivity prevails. The demand for forge iron is so small that, for the time being, it is possible to execute orders from stocks still remaining at the furnaces. The scarcity of foundry iron is regarded as a very serious matter by the engineering firms in the district. With Belgian No. 3 foundry pig selling here at less than 140s., and forge qualities obtainable at 115s., there is no inducement to British smelters to re-start their furnaces. The smelter's complaint is that he has to pay twice the pre-war price for his coke, while the quality is so poor that in many cases he is compelled to use 50 per cent. more fuel, and this combination of inferior quality and high price makes it impossible to produce pig iron at current prices. Nearly all the coke ovens, like the furnaces, are idle, the coke maker stating that it is impossible to sell coke within £1 per ton of the figure offered by the blast-furnace owners. It is interesting to note that Belgium is supplying us with an increasing tonnage of pig iron which we cannot make for ourselves. This year Belgium has brought more blast-furnaces back into use, raising the total from an average of thirteen last year to over twenty. She has still between thirty and forty furnaces out of action. Of those in blast last month, seven were producing 782 tons of foundry iron, and fifteen were producing 2080 tons of steel per twenty-four hours. Cleveland forge iron is on offer here at a price which works out at about 142s. 6d. delivered. The forges, however, refrain from buying.

The Coke Ovens and the Blast-furnaces.

The coke makers are still quoting furnace coke at about £3 per ton, and the smelters state that pig iron cannot be made at a profit unless they get their coke at something like £1 10s. delivered. At £3 per ton the coke makers explain they cannot produce fuel profitably. For the present, therefore, blast-furnaces are not being re-started for the production of pig iron for sale, and they are not likely to be for some time to come. The matter is, in fact, not being considered. Obviously, neither furnace owners nor proprietors of coke ovens are reconciled to the prospect of their plant remaining idle. The makers of coke are a little more disposed towards negotiation than they were when the pits re-started, and a certain amount of informal discussion continues to take place between the parties. It is thought likely that a conference will be arranged shortly to discover whether a working price can be arrived at, but any general resumption is now unlikely until after the August holidays. One furnace is reported to be preparing to light up in Nottinghamshire, and another in North Staffordshire, but in both cases the circumstances are exceptional. Four furnaces on the North-East Coast connected with the steel trade are expected to be in operation by the time this letter goes to press. In other directions comparatively little has been done towards setting the iron and steel industry on its feet again, nor can anything effectual be done till production costs approximate to those of other countries in Europe.

Trade and the Waterways.

Birmingham traders are greatly interested in the second interim report just issued by the Government Committee of Inland Waterways, over which Mr. Neville Chamberlain, the leading member for Birmingham, presides. The matter of improving canalisation will always be one of first importance to Birmingham, since its industries are now so greatly handicapped in the matter of oversea trade by the circumstance that the

producing works are situated so far away from the ports and in the very centre of the kingdom. Local manufacturers recognise this week that the financial stringency offers an insuperable obstacle to the widening of British waterways at the present time. No disappointment is therefore occasioned that the Parliamentary Committee reports that the problem of the development of the canals as a whole cannot be dealt with at the present moment. At the same time sufficiently good reasons are advanced why at least preparations should be made for comprehensive action later. To this end it is suggested by the Committee that an experiment should be made with the Trent group of canals by the formation of a Trust designed to acquire and unify the waterways in the area and work them to the best advantage. Even a limited experiment of this kind is admitted to involve some risk—presumably financial—but this is justified by reference to the valuable experience which would be gained. It is clear that no unifying Trust could operate successfully unless it had control of some, at least, of the canals owned by the railways. But control could not be obtained by voluntary agreement with the companies. The Committee, therefore, suggests that a clause shall be inserted in the Railways Bill now before Parliament providing that "in the case of any Bill or Order proposing to transfer a canal or waterway owned or controlled by a railway company to a body of trustees or commissioners to be constituted by Parliament, the railway company shall not be entitled to be heard in opposition except upon the terms of the transfer." The effect of such a clause would be to give powers of compulsory purchase. This is a very important matter and is an entirely new departure. It is on this portion of the report and the arguments adduced in its support that Birmingham manufacturers have this week mostly centred their interest and criticism.

Steel.

The great steel works, with very few exceptions, continue idle, and reliable quotations are not easy to obtain. The minimum for Staffordshire half-product mild steel sheet bars continues to be, probably, £8 10s., and rises to £11 according to quality. Against this, continental billets have been sold at £7 10s. delivered. Concerning Belgian steel activities, it is interesting to note that the latest returns show an output of raw steel amounting to about half the pre-war standard. Refined steel, however, has not got within two-thirds of the 1913 figure, and finished steel is about half. Business at the Staffordshire steel works is restricted almost entirely to the re-rolling of steel, on which several mills in the district are engaged. A fair business is being done in steel gas strip at £12 to £13 and on to £14 per ton, which is quite £3 below the price of iron strip.

Repairing Staffordshire Mines.

Active steps are being taken in the South Staffordshire coalfields in connection with the drainage of some of the mines which were temporarily flooded during the recent strike. Operations have been delayed at the New Hawne Colliery, Halesowen, in consequence of two serious accidents, one of which caused extensive damage to the engine-house and necessitated the laying down of additional machinery. It is expected that several more weeks will elapse before the top seams of coal can be worked; in fact, it is very questionable if the bulk of the men engaged at this large pit will be able to resume work this year. Operations have also been re-started at the Witley Colliery, and it will be weeks before the officials can get rid of the water. At some of the other pits better progress is reported, and work may be in full swing soon after the holidays. A serious position exists in connection with the fire-clay mines, most of which are at present unworkable.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER, Thursday.

Iron, Steel and Metals.

THE general condition of the iron and metal markets is much as it has been for the last fortnight. The revival of trade which was hoped for after the end of the coal dispute is still delayed, and one can find no symptoms of improvement in any direction. The whole position is dominated by the fact that Great Britain is now one of the dearest countries in which to develop industrialism, and after two centuries of the very opposite circumstances, it is not surprising that trade cannot adjust itself to the new conditions. It is, of course, a question of adjustment or a permanent loss of industrial supremacy, and one watches anxiously for signs that both manufacturers and workmen are beginning to realise this truth. Other countries are showing more enlightenment, and one hears that Spanish workmen in the copper trade have voluntarily offered to increase their hours of work without receiving any extra pay.

Metals.

The non-ferrous metal market shows very little change at the moment, and with the single exception of lead, all the metals are as dull as ditchwater. There is very little demand in any direction, except that of Germany, where the reconstruction of industry goes on much faster than anywhere else. The Germans lost the war, but to all appearances they are going to win the peace, and, as it seems impossible to make them bear the cost of the war and of their abominable methods of conducting it, one begins to fear that they are the only nation which will get advantage from it. There has been very little business in copper here during the last week or two, and the low prices have no effect in stimulating consumption. America has been offering refined ingot at 12¼ cents per lb., but without bringing about much buying. The further depreciation of our sterling in terms of American dollars does not seem to have any effect on the price of copper, in spite of the fact that America is the chief source of supply. The price of best selected has been several times on a level with standard, and this of itself is quite enough to show how poor is the consumptive demand. Electrolytic remains some £3 or £4 per ton above best selected, but that is probably because of the unfavourable American exchange. There has been a small, and futile, alteration in the official prices for manufactured copper and brass. The price of copper sheets has been reduced to £105; but this still leaves a difference of £35 per ton between sheets and tough ingot copper, which is, of course, far too great, and could not continue if there were any proper freedom of competition in the trade. The reductions in tubes are negligible from the engineer's point of view. Brazed brass tubes for the home trade were last week dearer by £7 per ton than brazed copper tubes. In the market for tin there have been only a few fluctuations of minor importance. The price has remained between £160 and £170 per ton for about two months, and to have fluctuations confined during such a period within £10 per ton is unusual. The market is still waiting for a revival of buying from America, and apparently the consumption there keeps on the low side. The South Wales demand for the tin-plate trade has not yet wakened up, and it is reported also that the sales by the East are not equal to current production. So far as can be seen, there is no prospect of an immediate change; although the tin market is a dangerous one for the prophet. Lead has been again very firm, and English pig lead is now almost as dear as spelter, whereas there should be a difference of £10 between these metals. Spelter is weak and neglected, and the demand is feeble.

Pig Iron.

The situation in the Manchester pig iron market is much as it was, except that foundry iron becomes scarcer every week. There has been a little Cleveland iron sold, but only at high prices, for it is not possible to buy on the basis of the official price of £6 15s. on trucks. All the Midland iron furnaces are still idle, and one can get no definite information as to when they are likely to light up again. The theory is that when it is possible to make pig iron to sell at a profit at £6 per ton, some of them will start, and for a time there might be a demand at that price big enough to keep some of them going, but at present there is no prospect of getting coke cheaply enough, and one has a strong impression that when coke does come to a practicable figure, there will be no large market for pig iron at £6 per ton. At present, what remains of the stock of Midland No. 3 foundry brings £9 per ton, but there is only a very limited sale for it. Those founders who can work with foreign pig iron are getting it at £6, and sometimes at less, say, about £5 10s. Business in the Lancashire ironfoundries is very slack, and orders do not come in at all freely. Some of the stocks of forge pig and of hematite are being used up, but there is still plenty of hematite, and the furnaces which make it are not starting yet. Hematite can be had here as cheaply as No. 3 common iron.

Finished Material.

The market for finished iron and steel is very quiet, and it is clear that people cannot, or will not, pay the prices required. There was a rumour—which got into the Press—that Lancashire and Staffordshire bar iron makers had reduced their price for common—Crown—bars £2 to £14 per ton, but this was denied, both by the Staffordshire and Lancashire makers, and is officially contradicted. It would make no difference in the demand if the report had been true. Iron and steel works are receiving very few new orders now, and it is not surprising that they are slow in re-starting. In fact, it is doubtful whether there is enough trade to keep one-fourth of them going at half speed.

Scrap.

There is no market for any kind of scrap here, except cast iron scrap, and that is only a very small one. Dealers report that the demand is falling off, but so far prices here are kept up to £6 5s. for ordinary machinery scrap and £7 5s. for textile. There is some shell scrap which is rather cheaper. The foundries, however, are buying very sparingly, and it is only the scarcity and dearness of pig iron which keeps the market up.

Chester Electricity Supply Extension.

In order to cope with the increasing demands for electric power, the Chester Corporation has entered into a contract with the War Office for the use of the electric power plant at H.M. Factory, Queensferry, for a term of years. The installation comprises one 1000-kilowatt turbo-alternator and three turbo-alternators generating three-phase, 50-periods, 440-volt current at 1500 revolutions per minute. In order to raise the voltage to 33,000 for transmission purposes, step-up transformers will be provided and underground cables will be laid from the power-house, through the factory grounds and across the river Dee. From this crossing a six-wire 0.1in. section, overhead transmission line will be carried to a sub-station at Chester, where the 33,000-volt current will be stepped down to 6600 volts, and conveyed to the existing electricity works, where a 1000-kilowatt rotary converter is to be installed, and to two sub-stations, one adjoining the works of the Chester Hydraulic Engineering Company and the other adjoining the engineering works of Brook, Hirst and Co. At each of the latter sub-stations a 500-kilowatt rotary converter will be installed and connected to the general direct-current system of distribution.

A Labour View of the Cotton Industry.

Speaking on Monday last at the conference of cotton operatives which is being held at Blackpool, Mr. Walter Gee, the President, when reviewing the future prospects of trade, said that he was optimistic. If they could only get rid of the present high-priced stocks, trade would begin to move. He gave the following reasons for optimism:—That for a long time many of the mills were employed on war work; that from 1917 to 1919 production was largely restricted by the operations of the Cotton Control Board; that hours of labour had been reduced from 55½ to 48 per week; that since last October or November the mills had not worked more than half-time on the average; that other cotton-producing countries also had reduced their hours of labour in about the same proportion as in this country; that spindles and looms had not in the meantime been increased to any considerable extent; and that new mills had not been built in any great numbers. In these circumstances, he maintained that there must be some places where cotton goods were greatly needed.

BARROW-IN-FURNESS, Thursday.

Hematites.

The position in the hematite pig iron trade of North Lancashire and Cumberland has not undergone any change during the past week, certainly not for the better, and prospects are far from being good. Up to the present, there has been no cheapening in the cost of coal and coke, and consequently there is no immediate chance of any of the furnaces being put into operation, as was hoped. The quotations remain practically unchanged all round, and at present rates business is impossible, for buyers decline to place contracts at anything like the old rates, and smelters are not yet in a position to make a cut of any moment. Any prospect of iron smelting in August has fallen away, and it is considered that it will be into the spring of next year before there is a run of activity. In the meantime, all the furnaces are standing idle, and business is in the background. There is nothing being done at the iron ore mines.

Steel.

In the steel trade nothing is being done in the way of producing, and nothing is looked for for some time. Two of the mills at the Barrow Hoop Works have experienced fair activity since fuel supplies improved, and the foundries have been engaged. There is no business in steel.

Shipbuilding and Engineering.

The usual week's holiday in these trades has been extended owing to the long continuance of the strike of wood workers, which is holding up many contracts in the shipbuilding departments, and on the engineering side work is very slack. The works at Barrow resume operations on short time on Tuesday, August 9th.

SHEFFIELD.

(From our own Correspondent.)

Weathering the Storm.

ALTHOUGH the wheels of industry are beginning to revolve again, the resumption is proving a rather slow business, and, as I write, there are still, I believe, some 50,000 or 60,000 workers idle in Sheffield alone. There are plenty of manufacturers who continue to regard the outlook lugubriously, but in spite of these there is no gainsaying that the end of industry's acute troubles is well within sight. The wonderful thing is that after the storm we have passed through the shore of commerce is not strewn with more financial wrecks than is the case. One cannot tell, of course, how near a thing it has been for many firms, but the known failures are relatively few and unimportant in this district, whilst there are numbers of firms that appear to have come through unscathed. So far as the public companies are concerned, the balance-sheet figures for the end of the current year will be awaited by shareholders with a little trepidation, no doubt, and it would not be surprising if in some instances dividends were curtailed or even withheld; but, generally speaking, I can discern no serious cause for anxiety on that account. Owing to the difficulty the directors have experienced in settling accounts with the Government, Vickers have not, so far, paid any ordinary dividend for 1920, although their mortgage interest and preference dividends have been met as usual, but Brown's, Cammell's and Hadfield's have all made distributions to their ordinary shareholders, in the two first-named cases at rates only slightly lower than in the previous year. In the case of Hadfield's, the dividend was 5 per cent. against 10 per cent., but then it was paid tax free, which made it nearly 7 per cent. gross, and the company has this week declared an interim dividend for the six months to June 30th—absolutely the worst six months any living industrialist remembers—at the same rate as for the first half of 1920, which was quite a good and hopeful-looking period. Then there is the Brightside Foundry and Engineering Company, the directors of which have recently recommended that the dividend of 10 per cent., tax free, paid a year ago, be repeated on this occasion—a recommendation to which, it is safe to say, no shareholder will demur. It was much the same with Davy Bros., the engineers, the dividend of 7½ per cent., less tax, being at the same rate as for the previous year.

Coal Must be Cheaper.

But to return to a discussion of the actual trade situation—for I seem to have devoted a good deal of space to matters which arise out of that vital subject rather than really forming a part of it, although the things about which I have written help one to form an opinion regarding the trade situation. Steel furnaces are gradually being lighted up throughout the district, but large numbers remain cold, and there is even a fear that some of those put into commission may very shortly have to fall back on short time. The trouble is that with all the severe price-cutting that has taken place this year, foreign makers are managing to keep their quotations well under ours, with the result that business which might have come this way is going abroad. This reminds me that the report, so widely spread, that Guest, Keen and Nettlefolds had taken a contract for the supply of steel rails to India at £10 2s. 6d. a ton proved to be groundless. Readers may recall, perhaps, that my letter drew attention to the remarkable fact that this quotation was stated to have undercut a Belgian tender, notwithstanding the fact that the Belgians were reported quite recently to have booked an order from the Argentine for over 90,000 tons of steel rails at £10

a ton. In repudiating the whole story—the origin of which is now being sought—Guest, Keen and Nettlefolds observe that British steel cannot at present be made at the figure. It might be, however, before very long if only coal could be brought down. A large employer of labour only this week urged me to lose no opportunity of impressing on consumers the wisdom of refusing to pay the increased prices which some collieries and merchants are said to be demanding. The meeting at Derby a few weeks ago, at which Yorkshire, Derbyshire, Lancashire and Nottinghamshire coalowners were present, and at which it was agreed to raise the price of certain steam coal by 1s. a ton, unless contracts of at least twelve months were entered into, and the price of house coal by 3s. a ton—the advance to be reckoned on the pre-strike quotations—is now stated to have been very thinly attended, and therefore to have been really unrepresentative. Certain it is that some important collieries are determined to make no advance, and in this difference of opinion—this rift in the lute—lies the hope of an ultimate fall in prices. Steelmakers and manufacturers alike urge the great need of a reduction by some means or another in coal and coke values as a prelude to any real revival in the iron and steel industries. Indeed, it is said that ironmasters and coke producers are already conferring together on the question of dropping the price of coke to a level that will enable furnaces to be put in blast again on a profitable basis.

The Trade Situation.

Whether it is literally so or not I cannot say, but a message I received on Monday last to the effect that one of the Butterley Colliery Company's blast-furnaces was to be lighted up the next day added the belief that that was the first of the 400 furnaces in this country to be put again into commission. In any case, one should expect to hear any day now of the lighting up of blast-furnaces, for just as the situation deteriorated through the influence of economic forces by the same agency, the tide having turned, industrial conditions must now improve in spite of every apparent obstacle. Manufacturers of all kinds of railway material, particularly tires, axles and springs, are anxiously anticipating a big constructional movement by the leading home railways. It cannot be said that plants, which were never in such an excellent condition of preparedness, are as well employed as they might and really ought to be. In pre-war days home markets were very important ones for railway material departments, but since the Armistice hopes have been chiefly centred on orders from oversea sources, simply because the home railways appear to be doing as little as possible in the way of new building. The reason hitherto has been that the companies were uncertain what to expect at the hands of the Government; but as the moment of de-control approaches the hope is revived that some of the railway lines will launch fairly big construction programmes, though at the time of writing, it must be said, little of the kind is known of a definite character. Heavy engineers are busy on old contracts, electrical engineering seems fairly good, there is a continued demand for certain lines of small tools, and makers of builders' iron and steel and light castings in iron are not experiencing a bad demand. Some interesting developments, I hear, are being made in manufactures from stainless iron, this material being said to have most of the characteristics of stainless steel, but to be ever so much more easily worked. That being the case, various goods, even to teapots, are being produced, though, so far, only in the experimental stage. One drawback appears to be the price, but that, of course, time and experience should rectify. Another new material creating a certain amount of interest consists of a mixture of nickel and copper which has a tensile strength of about 42 tons to the square inch. It is hard to work, but under 1000-ton presses it is being made up into almost any article usually made of nickel, electro-plate or silver, and is given a glass-hard surface which is claimed to be untarnishable.

NORTH OF ENGLAND.

(From our own Correspondent.)

Industrial Position Improving.

SIGNS are not wanting that the industrial position generally in the North of England is daily improving, and gradually recovering from the effects of the coal war. The task of restarting many sections of industry, however, is a heavy one, and is attended with enormous difficulties, but the progress made up to the present is fairly satisfactory. The number of unemployed has dropped considerably, but much has yet to be accomplished before there is a general resumption of work, and many thousands will continue to be unemployed for some time to come. Apart from the completion of alterations to pithead plant at some of the collieries in Northumberland and Durham which is delaying the restarting of men, practically all the mines are now working regularly, and it is believed that so far as a general resumption is concerned, these counties have suffered less in getting back to work to normal conditions than almost any other mining district. The output is now on a very satisfactory scale, but complaints are general regarding the high prices asked for coal. The position in this respect constitutes a vital factor in the iron and steel trade outlook. Producers declare that pig iron and steel cannot be manufactured profitably with coal and coke at their present figures, which will need to be very substantially reduced if the iron and steel trade is to carry on. They are accordingly pursuing a cautious policy, and until cheaper fuel is available, a general resumption of work in the iron and steel trades would seem to be improbable. Increased activity is reported at the shipyards and engineering works, but little new work is coming forward.

Cleveland Iron Trade.

The Cleveland pig iron trade shows very little signs of opening out. The position at the moment is very disappointing. The general depression in trade and the high cost of fuel are the dominating factors. With furnace coke not even a paying proposition at 45s. per ton delivered, it is futile to expect any general resumption of pig iron manufacture. Seven blast-furnaces have already been restarted or are on the point of going into blast, but the basic product of five of them is exclusively for the steel works, and most of the output of the other two, which will be on Cleveland foundry iron, will not come on to the market. Iron, even at 120s. per ton, cannot be produced with coke at anything near 45s., and until coking coal, and therefore coke, is very substantially reduced, pig iron making in the North of England must continue to be at a practical standstill. In the meantime, the business passing in No. 3 Cleveland now available is all but negligible. The present price is 135s., while for August 140s. is named, with a premium of 5s. per ton for export. This puts export business right out of count, for continental foundry iron is selling, c.i.f. British ports, at round about £5 per ton. Foreign basic iron, too, is procurable, delivered in the Tees, in the region of 85s. There is no change in the quotations for the lower grades, No. 4 forge and mottled being 117s. 6d., and white 115s., but the demand for these descriptions is very poor.

Hematite Pig Iron.

The furnaces on hematite are still idle, and the present position of business, not to speak of the prohibitive cost of fuel, does not encourage resumption. The home demand is extremely quiet, and it is questionable whether even a reduction of the price of mixed numbers by 20s., bringing them down to the export level of 140s. per ton, would have the effect of inducing business. Inquiry from abroad is very feeble, and the big increase in the Italian import duties will further depress business with that country.

Iron-making Materials.

The stagnation in the foreign ore trade continues. It is difficult to get consumers to take delivery of cargoes contracted for and suspended ever since the strike, and there can be no talk of new business till works get going again and existing stocks are reduced.

Manufactured Iron and Steel.

In the manufactured iron and steel trades the position as regards new business shows no improvement. Consumers, faced by depression in their own trades, and by the high cost of fuel, are holding off, and the volume of new orders coming out is extremely disappointing. A few works with contracts in hand have got into operation, but a general restart cannot, it is to be feared, be looked for for some time to come. Continental steel prices seem inclined to harden, but it is stated that joists and angles have been offered at £3 15s. below the home prices, and billets at £7 10s. With such prices as these, British steel makers simply cannot compete, and it is not surprising that orders are extremely scarce.

Dull Outlook in Shipbuilding Trade.

Material needed in the shipyards and engineering works is again coming to hand, and many firms which have been working short time are now finding fuller employment. There is an entire absence of inquiry for new tonnage, and the orders which still remain on hand are steadily approaching completion. The shipyard joiners' strike, which shows little or no hope of settlement, is an unfortunate factor on the North-East Coast, as in other shipbuilding centres. Several vessels would soon be launched if their joinery work could only be completed. Berths occupied by these vessels would then be available for others. Repair work, too, is having to be sent abroad. The outlook is indeed a cheerless one, and there would seem to be no hope of better things until world trade revives sufficiently to absorb the present tonnage congestion, and costs of production fall very substantially below the present level.

The Coal Trade.

The rigidly firm tone which has prevailed in the Northern coal market during the past two or three weeks is still maintained for all prompt or early August business, and the recent high figures are still to be obtained for any class of fuel. The outlook, however, seems to point to an easier situation, with more resilience and an opportunity to trade on more reasonable terms. The home call is not so full or insistent, and inland stocks are accumulating, while there are constant arrivals of foreign fuels into the East Coast harbours from Canada, America and also continental ports, and these will continue for some time. The quantities involved are exceedingly large, and cannot do other than adversely affect the prices from the colliery owners' point of view. Other home markets are also easing down, so that during the next few weeks the situation ought to settle down to a more equitable and economic level, and thereby enable the exporters to get a look in. As yet there are very few actual transactions for shipment being booked, despite a heavy and varied inquiry, which shows quite clearly that the foreigner will not pay the present high figures, and is consistently and decidedly holding off until he can buy more cheaply than at present. It is reported that Hordon screened steams have been sold for early August delivery to Stockholm at 51s. c.i.f., and also that D.C.B. smalls have been sold for the same place at 21s. 9d. c.i.f., also for August shipment, which apparently discloses the fact that discounts are being given, and also that lower values may be realised in the near future. The output at the collieries in both counties is gradually improving, the miners being reported to be working very well, and thus there is a better prospect of obtaining supplies than hitherto. The position in the coke trade is unchanged. Production is limited and the turnover at present is negligible.

Colliery Improvements.

The Seaton Delaval Coal Company, Limited, is at present engaged on a big project at New Delaval for increasing the output and developing the colliery. The scheme involves over half a million of money. Extensive new machinery is being erected, and coal now taken on the surface from the Relief Pit to New Delaval will be carried underground and drawn at the New Delaval shaft. Important alterations are also being made underground. Already provision has been made for gradually absorbing the unemployed men at the colliery, a considerable number having been restarted this week.

SCOTLAND.

(From our own Correspondent.)

Continued Quietness.

MARKETS still present a holiday appearance. Lack of orders consequent on the coal strike and the continued high cost of fuel, leave the outlook uncertain, and offer little inducement to reopen works at present. Here and there some concerns have restarted certain departments, but they have done so chiefly in order to work off existing orders, and an all-round resumption seems distant. Some consolation may be found in the increasing inquiries for all classes of materials in steel and iron, which appear to hold out a probability of good business when prices are once more on a competitive basis. In some districts, too, the collieries are approaching pre-strike activity, while some are said to be booked well ahead. Until supplies and prices are more definite, however, markets are unlikely to show much life.

Miners and Leaders.

Though the movement for reconstruction engineered by the miners extends all over the country, the scheme proposed by the Blantyre miners seems generally to be considered too drastic. The Blantyre motion called for the immediate resignation of all officials, and if re-elected to be subject to an annual ballot. Reconstruction is universally called for, and there is also a strong feeling that officials should concentrate more on union matters and less on political propaganda.

Levies for Unemployed.

The majority of the miners are now contributing regularly to the support of men not yet re-engaged. In one district, too, a voluntary collection was taken among the miners, and each of the unemployed received a donation of 10s.

Mine Managers' Claim.

Mine managers in Scotland are putting forward a claim for the recognition of the annual holidays, and also for compensation in respect to the extra work they performed during the strike period. Some of the larger firms in Scotland have already shown their appreciation of the services of their managers and under-managers during the strike, and have given gratuities amounting from £20 to £40 in some instances. Those to whom compensation for overtime has already been given are joining in with the others in their claim for recognition of the holidays.

Pig Iron Scarcity.

Business in the Scotch pig iron market is very quiet. Foundry qualities are becoming very scarce, and some makers are out of the market altogether. Forge quality also is now in very poor supply. There is no likelihood of a restart at the pig iron furnaces until fuel is much cheaper. Owing to the inflow of cheap foreign material, local sales are likely to be smaller than formerly.

Finished Iron and Steel.

With one or two exceptions, the Scotch steel and iron works are still closed. A fair resumption may take place at the beginning of August, but it may be some weeks longer before a general restart is made. In view of the continued high costs of production, makers are not in a position to entertain inquiries, and therefore are likely to postpone a re-opening until conditions are more favourable.

Coal.

Conditions in the coal trade are improving slowly but evidently surely. A few hundred more miners have been able to get a start during the past week, both in the west and eastern districts. Some collieries in Lanarkshire are said to be booked up until the end of this year. Supplies of coal are a little better, and prices show a falling tendency. The industrial demand is still weak, and with railways and municipal consumers well supplied, more fuel has been available for shipment. Aggregate shipments for the past week amounted to 85,355 tons, against 68,063 tons in the preceding week and 168,908 tons in the same week in 1920.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Miners in Conference.

THE South Wales Miners' Federation has held its annual conference, but it has differed from previous gatherings of this character, inasmuch as its deliberations and resolutions have not caused anxiety to those who are interested in the commercial side of the industry. Yet it was resolved, by 120 votes to 63, that the Miners' Federation of Great Britain at its annual conference be urged to affiliate and actively identify itself with the Third International. It will be recalled that the Independent Labour Party at its last annual conference negatived a proposal to affiliate with Moscow, so that the decision of the South Wales miners' conference will no doubt occasion some surprise. It will not, however, cause anything like the anxiety that some of the extremists would desire, as scarcely anyone expects that the annual

conference of the Miners' Federation of Great Britain will support the proposal. Furthermore, although the resolution will go forth in the name of the South Wales miners it is practically certain that were the proposal properly laid before the rank and file it would be turned down.

Unemployment.

Numerous questions were discussed at the conference, but it is significant that all the resolutions from the various districts regarding a six-hour day, or a five-day week and seven hours' shift were deferred until the next conference. The subject of unemployment was well to the fore, and it was resolved that a recommendation should be made to the lodges that all workmen at present in employment should be asked to contribute a levy of 5 per cent. on their earnings and to agree that this should be retained at the colliery offices for the relief of those out of work. The replies from the various lodges have to be sent to the general secretary by Saturday next. The conference accepted the recommendation of the National Executive Committee, which means the removal of the miners' boycott on the operation of the Mining Industry Act, while the future status of the president of the M.F.G.B. was another matter of discussion. It was decided that in the opinion of the South Wales Federation the presidency should be an annual part-time appointment. If adopted nationally this decision will mean that the future president will not occupy the position held by Mr. R. Smillie as the permanent head of the Federation, and in that event it is presumed that the general secretary will become the chief administrative official, as is the case in the South Wales Federation.

Conditions of Restarting Work.

A circular has been issued by the South Wales Miners' Federation setting forth the interpretations placed by the owners on two important clauses of the recent national agreement for the resumption of work in the coalfield. The announcement is also made that every colliery manager is expected to observe the conditions, and in cases in which that is not done the workmen should at once communicate with their miners' agent. The first clause states that there is no obligation upon any colliery owner to re-start all or any of his pits or any district in a pit, but if a colliery does re-start working it must do so upon the terms and conditions obtaining on March 31st, except in so far as they have been varied by the terms of settlement or by mutual arrangement. The second section states that Clause 13 provides that every workman must go back to his place when that place is made available for him, save in cases in which the process of dismantling is in operation preparatory to abandoning the mine.

Ebbw Vale Trouble.

Efforts have not been relaxed to bring about a settlement of the trouble at Ebbw Vale, where work was not resumed after the national agreement owing to conditions stipulated by the Ebbw Vale Company. As a result, however, of the negotiations between the men's representatives and the employers a temporary settlement has been arrived at. The conditions upon which the Ebbw Vale men could re-start work were explained to the workmen on Tuesday by Mr. Vernon Hartshorn, and the first of them which the men had to accept was that all allowances or inclusive prices should be reduced by 50 per cent., and in the second place all day wage men's rates that were carrying allowances or men who were on a contract basis should be paid between 5s. 10½d. and 7s. 6d. pending arbitration on the point. Other terms in the schedule offered to the men are also to be the subject of arbitration. The Ebbw Vale men decided almost unanimously to accept the temporary arrangement, and work has been resumed at once wherever possible. All the men will not be able to secure re-employment, as the company has decided to abandon some of the districts at Vivian and Tillery pits.

Tin-plate Works.

The bulk of the tin-plate works in South Wales are still idle, partly as the result of the dearth of orders and partly owing to the high price of coal, but still the position was better this week than last as regards the number of works re-starting. On Monday last the Cwmbwrla works (eight mills) resumed operations, and a re-start has been made at two steel furnaces belonging to Richard Thomas and Co. at Llanelly, and at steel furnaces and mills at Morriston and Port Talbot, while others are in operation at Mellingriffith, Pontypool, Caerleon, &c. The next week or two will probably see more mills re-starting, but as regards the prospects of others the position is doubtful, and it may be quite a long time before the situation enables them to resume.

Notable Ship Repairing Manager.

On Friday last the death took place at his home at Dinas Powis, near Cardiff, of Mr. Robert Monroe, M.I.N.A., M.I. Mech. E., who was one of the best known and respected ship repairers in South Wales. Mr. Monroe, who was seventy years of age, had been associated with the ship repairing industry of the Bristol channel for over forty years. A native of Houston, Renfrewshire, he came to South Wales in 1879, and was for twenty-one years with the Penarth Slipway Company, but in 1900 he became general manager of the Barry Graving Dock and Engineering Company, Limited, which position he held up to quite recently. He played a prominent part in the formation of the Bristol Channel Engineers' and Shipbuilders' Employers' Association, which was instituted in 1888, and from 1898 up to the time of his death he was honorary secretary of the organisation, of which he was chairman in 1891 and again in 1910, so that in the latter year he held the dual position of chairman and honorary secretary. During the war when the Department of Director of Ship Repairs was formed, Mr. Monroe was appointed District Superintendent for the Bristol Channel, and held that office until May 31st, 1919, when control of ship repairing was removed.

Current Business.

Under the influence of increasing outputs the coal market shows an easier tendency, more especially as regards steam qualities, while it is evident that now that pressing orders which accumulated during the strike are being worked off, business is not coming along so freely. The fact is that a fall in prices is looked for, and consequently buyers abroad are not purchasing anything more than they can help, while there is no doubt that much of the coal which has been arranged for export is for use in mixing with foreign coals, and in this way in helping to consume stocks now in hand which are not the equal of Welsh coals in quality. The probability is that although loading pressure this week is very considerable and will continue during the first week of next month, values will give way the second half of next month. At the moment superior Admiralty large coals are 45s. to 47s. 6d., but it would be no surprise if prices were down 5s. by the end of August. Superior steam smalls range about 25s. to 27s. 6d. Coke is 60s. to 65s., patent fuel 42s. 6d. to 47s. 6d., and pit-wood about 40s. Anthracite coals keep in quite good demand, and values are on the basis of large 55s. to 60s., nuts 72s. 6d., cobbles 70s., beans 65s., and peas 45s., while rubbly culm is 22s. 6d. to 25s., breaker duff 15s. and billy duff 10s.

Latest News from the Provinces.

LANCASHIRE.

MANCHESTER.

The Engineering Trade.

THE outlook for the engineering industry of this district shows no sign of improvement in spite of the recent settlement of the various labour troubles, and with the holiday season in full swing any immediate amelioration of the existing slackness is not to be expected. Short time and diminished staffs are general, with but few exceptions. There is no section of the local engineering trade which is suffering as severely from the depression as the machine tool builders. Locomotive builder are well off for work, and some of the textile machinery makers have not much to complain of in this respect; but, these branches apart, the situation can best be summed up as bad. It is thought by many who are in a position to gauge the conditions, that orders are being withheld until after the second reduction in wages in the engineering trade, when there is likely to be a further considerable reduction in the prices of machinery in which the chief factor in production is labour. Foreign competition becomes more and more acute. The head of a well-known firm of electrical engineers informed me recently that an order for £27,000 worth of plant had recently gone to a German firm whose price was far and away below that of its nearest British competitor.

SHEFFIELD.

Foreign Tariffs.

The local Chamber of Commerce has had before it the question of the raising of import duties by the United States, France, Italy, Spain, Australia, Switzerland and other countries, the effect of which, it is felt, is certain to be in the restriction of our export trade. The United States Tariff Bill contains proposals for increasing the duties on special crucible steels containing alloys, which will practically make the cost of such materials, if imported, prohibitive, and shut out Sheffield's products. Heavy duties are also placed upon tungsten, molybdenum and other ferro-alloys. The duties on cutlery and tools are increased on an average 25 per cent. France has increased its duties on all classes of steels made in Sheffield.

WALES AND ADJOINING COUNTIES.

Patent Fuel Workers' Wages.

Although another meeting has been held between parties concerned, no agreement has been come to respecting the wages of patent fuel workers. The owners' application is for a 4s. per day reduction, representing about 20 per cent. decrease in wages. The men's representatives, it is understood, were prepared to recommend the men to accept a reduction of 2s. per day from August 1st, and a further reduction of 1s. per day as from January 1st next. The owners have promised to consider the men's counter-proposal.

Engineers' Wages.

At a joint meeting of the Welsh Founders' and Engineers' Board at Swansea consideration was given to a claim from the employers for a further reduction in wages of 15s. for skilled and 11s. 3d. for unskilled men. No settlement was arrived at, but it is hoped negotiations will be resumed.

THE cessation of control on August 15th will be almost coincident with the jubilee of the passage of the Act which authorised control. This was the Regulation of the Forces Act, 1871, which received the Royal Assent on August 17th, and in which was buried away a section authorising the Government, in the event of the emergency arising, taking over the railways. Another interesting fact is that three days earlier, i.e., on August 14th, the Royal Assent was given also to the Regulations of Railways Act, 1871, which extended the powers of the Board of Trade as to the inspection of railways to all new work on existing lines, and gave the body formal authority to inquire into railway accidents. Since 1840 accidents had been reported to the Board, and had been inquired into, but there was no legal sanction for the latter step.

LAUNCHES AND TRIAL TRIPS.

CITY OF PITTSBURG, geared turbine steamer; built by Palmer's Shipbuilding and Iron Company, Limited, to the order of the Ellerman Lines, Limited, of London; dimensions, 465ft. 9in. by 58ft. 6in. by 34ft. 6in. moulded to upper deck; to carry about 12,100 tons deadweight. Engines, turbines of Parsons' impulse reaction type with double gearing, pressure 225 lb. per square inch; constructed by the builders; Schmidt's superheaters fitted.

SCALFARIA, tank ship for carrying oil in bulk; built by Swan, Hunter and Wigham Richardson, Limited, to the order of the Anglo-Saxon Petroleum Company, Limited, of London; dimensions, 427ft. by 53ft. 4in. by 31ft. moulded to upper deck; to carry 8450 tons on a draught of 24ft. 8in. Boilers oil fired; launch, July 22nd.

PENCARROW, steel screw steamer; built by Irvine's Shipbuilding and Dry Docks Company, Limited, of West Hartlepool, to the order of the H. B. Chellew Steam Navigation Company, Limited, of Cardiff; dimensions, 402ft. 6in. by 52ft. extreme beam and 29ft. 6in. depth moulded; to carry over 8000 tons on moderate draught. Engines, triple-expansion, 25½in., 42in., and 70in. by 48in. stroke, pressure 180 lb.; constructed by Richardsons, Westgarth and Co., Limited; trial trip, July 23rd.

CONTRACTS.—The municipality of East London has placed an order for two motor fire-engines with John Birch and Co.; Limited, of London-wall Buildings, E.C.

EXHIBITION AND TRIALS OF MOTORS AND TRACTORS BURNING PALM OIL.—A small exhibition of motors and tractors running on vegetable oils, fuel oil and suction gas from tropical refuse will be held in Brussels at the end of August, in connection with the trials of tractors burning palm oil, organised by the Belgian Colonial Office. Particulars can be obtained from the Department of Colonial Agriculture, 7, Rue Thérésienne, Brussels.

PRESENTATION TO COLONEL SAXTON WHITE.—To mark his retirement from the firm of Sir W. G. Armstrong, Whitworth and Co., Limited, Colonel Saxton White was recently made the recipient of a silver cigar box and holder and a silver inkstand, subscribed for by the officials and staff of Walker Shipyard and some of the officials of the Armstrong Yard. Mr. H. G. Williams, who made the presentation, remarked that there was not time to give a detailed account or even a synopsis of Colonel White's long and successful career; that would take a summer's day. It was sufficient to say that they and everybody else, both in this country and in other countries connected with shipbuilding, knew that Colonel White was one of the leading lights of the profession and that his influence would continue to be felt for many a long day to come. Colonel White, in replying, said it was with very great pride he accepted the gifts. As Mr. Williams had remarked, he had spent perhaps the biggest part of his life's work at Walker Shipyard and Armstrong Yard, and it was a great pleasure to him to know that at the former they had, as it were, made two blades of grass grow where one has grown before. He thought they had achieved that at Walker. He was very proud when they were entrusted with the building of the biggest oil tank steamers in the world. At home he often thought of the coal strike, the joiners' strike, and other labour difficulties, and feared what the result of all these stoppages might mean; but he was glad to be able to congratulate Mr. Williams, Mr. Coller, Mr. Douie, and all at the yard on the number of ships they had put into the water during the past six months.

ACCIDENTS DUE TO POISONING BY GASES.—In the recently issued fifty-seventh annual report on alkali, &c., works it is stated that the year 1920 was fairly free from serious accidents due to noxious gases. Three fatalities occurred at tar works. In one case a workman was overcome while clinkering the still fire; oxygen treatment revived him, but he died twenty-four hours later. The bulk of the evidence pointed to poisoning by carbon monoxide. In the other cases the noxious gas was sulphuretted hydrogen, inhaled during the cleaning of plant interior. During the cleaning of stills physical isolation is, says the report, absolutely essential, as also is thorough ventilation. Sulphuretted hydrogen was responsible, also, for the gassing of four men at the large sulphate of ammonia plant of a coke oven works; fortunately all recovered. The accident occurred during the clearing of a blockage. The District Inspector happened to be visiting the works at the time of the occurrence, and was thus able to get valuable information by an immediate investigation. Improvements, it is explained, which should obviate any possibility of a similar occurrence in future, have been introduced. There was one fatality during the cleaning of mixed acid tanks. The report continues that the possible danger attending the entering of acid tanks for the purpose of cleaning cannot be too strongly emphasised. A high-pressure water hose will usually effect the removal of mud, and such hose can be manipulated from outside the tank. Should entry of a workman be absolutely necessary for any purpose, the possible presence of nitrous or other noxious gas should be guarded against, and there should be thorough ventilation by a special supply of air; moreover, it should be borne in mind that, in the case of nitrous gases, absorption respirators are not to be relied on; they may even give a false sense of security.

INDIAN INDUSTRIES AND LABOUR.—The second part of Vol. I. of the *Journal of Indian Industries and Labour* was recently published. In it Sir Thomas Holland contributes an article on the principles which govern the grant of mineral concessions in India. The article concludes with a useful summary of the rules for the grant of prospecting licences and mining leases which are at present in force in British India. An account of the Rajputana salt industry, with particular reference to the salt works on the Sambhar Lake, is given by Mr. P. C. Scott O'Connor, an officer of the Northern India Salt Revenue Department. Mr. J. W. Meares, in an article entitled "The Hydro-electric Survey of India," explains the potentialities of India in the matter of sources of water power. Mr. Clow contributes an article on the subject of "Factory Children and Education." The subject of "The Hide, Skin and Leather Trades and Boot and Shoe Manufacturing in India" is treated by Sir Henry Lodgard, who was until recently the Honorary Adviser to the Government of India on Boot Production. An address on the subject of chemical research for the development of industries in India, which was read by Dr. E. R. Watson at the last meeting of the Indian Science Congress, is reproduced as an article in the *Journal*. An outline of the present position of technical and industrial education in Bengal is the subject of a short article by Mr. W. H. Everett, which deals with education under the heads of civil engineering, surveying, mechanical and electrical engineering, mining, weaving, commercial education and art. Other items of interest are a summary of information regarding industrial disputes in India during the first quarter of the year; miscellaneous notes on various subjects, including the bleaching of shellac; the investigation of cotton stalks as a papermaking material; three short notes on subjects of industrial interest contributed by Sir Alfred Chatterton and a statement showing the kind, quantity and cost of stores purchased in India by Government during the three official years ending 1919–20. A new feature of the *Journal* is the publication of reviews of recent publications.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. COAST—	
Native	49/- to 60/-
[1] Spanish	30/-
[1] N. African	30/-
N.E. COAST—	
Native	—
Foreign (c.i.f.)	37/6

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
SCOTLAND—[2]		
Hematite	9 0 0	—
No. 1 Foundry	8 15 0	—
No. 3 ,,	8 10 0	—
N.E. COAST—		
Hematite Mixed Nos.	8 0 0	7 0 0
No. 1	8 2 6	7 12 6
Cleveland—		
No. 1	—	—
Silicious Iron	—	—
No. 3 G.M.B.	6 15 0	7 0 0
No. 4 Foundry	6 15 0	7 0 0
No. 4 Forge	5 17 6	6 2 6
Mottled	5 17 6	6 2 6
White	5 15 0	6 0 0
MIDLANDS.		
Staffs.—		
All-mine (Cold Blast)	17 0 0 to 17 7 6	
Part Mine Forge	8 0 0	
,, Foundry No. 3	9 0 0 to 9 5 0	
Northampton [2]—		
Foundry Nos. 2 and 1	8 10 0	
,, No. 3	8 5 0 to 8 10 0	
,, Forge	6 17 6	
Derbyshire [2] *(All nominal)*—		
No. 3 Foundry	8 15 0 to 9 0 0	
Forge	7 0 0	
Lincolnshire [2]—		
Basic	*Uncertain.*	
Foundry	,, —*some sold at £8*	
Forge	,,	
N.W. COAST—[2]		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	8 0 0	
Special	9 0 0 to 11 0 0	

MANUFACTURED IRON

	Home. £ s. d.	Export. £ s. d.
SCOTLAND—		
Crown Bars	16 0 0	25 0 0
Best ,,	17 0 0	—
N.E. COAST—		
Crown Bars	16 0 0	19 0 0
Best ,,	17 0 0	20 0 0
Tees	15 10 0	15 10 0
LANCS.—		
Crown Bars	16 0 0	—
Hoops	20 5 0	20 0 0
S. YORKS.—		
Crown Bars	16 0 0	—
Best ,,	17 0 0	—
Hoops	20 5 0	—
MIDLANDS—		
Marked Bars (Staffs.)	20 0 0	—
Crown Bars	16 0 0	—
Nut and Bolt Bars	16 0 0	—
Black Sheets, (dbls.)	18 0 0 to 20 0 0	
Galv. Sheets, 24 W.G. (f.o.b. L'pool, or equal	24 0 0 to 26 0 0	
Gas Tube Strip	20 0 0	—

STEEL.

	Home.[3] £ s. d.	Export.[6] £ s. d.
SCOTLAND—[4]		
Boiler Plates	20 0 0	24 0 0
Ship Plates ¾in. and up	15 0 0	—
Sections	14 10 0	—
Steel Sheets ⅛in. to ⅜in.	16 5 0	—
Sheets (Gal. Cor. 24 B.G.)	—	26 0 0

STEEL (*continued*)

	Home. £ s. d.	Export. £ s. d.
N.E. COAST—		
Ship Plates	15 0 0	15 0 0
Angles	14 10 0	14 10 0
Boiler Plates	21 0 0	21 0 0
Joists	14 10 0	14 10 0
Heavy Rails	14 0 0	—
Fish-plates	19 0 0	—
Channels	20 0 0	—
Hard Billets	13 0 0	—
Soft Billets	11 10 0	—
N.W. COAST—		
BARROW—		
Heavy Rails	14 0 0	—
Light ,,	17 0 0 to 19 0 0	
Billets	13 0 0	—
Ship Plates	15 0 0	—
Boiler ,,	21 0 0	—
MANCHESTER *(Prices irregular and uncertain, unchanged)*—		
[7] Bars (Round)	14 0 0 to 16 0 0	
[7] ,, (others)	15 0 0 to 16 10 0	
Hoops (Best)	20 5 0	20 0 0
,, (Soft Steel)	17 5 0	17 0 0
Plates	15 0 0	—
,, (Lancs. Boiler)	21 0 0	—
SHEFFIELD *(Prices irregular and uncertain)*—		
Siemens Acid Billets	13 0 0	—
Bessemer Billets	17 10 0	—
Hard Basic	13 0 0	—
Soft ,,	12 0 0	—
Hoops	17 5 0	—
Soft Wire Rods	13 5 0	—
MIDLANDS—		
Small Rolled Bars	13 0 0	—
Soft Billets and Bars	12 0 0	—
[2] Hoops	17 0 0	—
Tube Strip	12 10 0 to 13 10 0	
Angles and Joists	14 10 0	—
Tees	15 10 0	—
Bridge and Tank Plates	15 0 0	—

NON-FERROUS METALS.

SWANSEA—	
Tin-plates, I.C., 20 by 14	24/- to 28/-
Block Tin (cash)	158 5 0
,, (three months)	160 5 0
Copper (cash)	70 0 0
,, (three months)	70 7 6
Spanish Lead (cash)	23 10 0
,, (three months)	23 2 6
Spelter (cash)	25 12 6
,, (three months)	26 7 6
MANCHESTER—	
[8] Copper, Best Selected Ingots	71 10 0
,, Electrolytic	75 10 0
[9] ,, Strong Sheets	105 0 0
,, Loco Tubes	0 1 3½
Brass Loco Tubes	0 1 1½
,, Condenser	0 1 5½
Lead, English	24 15 0
,, Foreign	23 15 0

(*Metal prices practically unchanged*).

FERRO ALLOYS,

(*All prices now nominal*).

	Per Ton.	Per Unit
Tungsten Metal Powder	2/- per lb.	
Ferro Tungsten	1/8 per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£35	12/-
,, 6 p.c. to 8 p.c. ,,	£37	15/-
,, 8 p.c. to 10 p.c. ,,	£36 10 0	15/-
,, Specially Refined		
Max. 2 p.c. carbon	£86	32/-
,, 1 p.c. ,,	£96	39/-
,, 0·75 p.c. carbon	£120	47/-
,, carbon free	2/9 per lb.	
Metallic Chromium	0/6 per lb.	
Ferro Manganese	(per ton) £18 for home.	
,, Silicon, 45 p.c. to 50 p.c.	£15 10 0 scale 8/6 per unit	
,, ,, 75 p.c.	£22, scale 12/- per unit	
,, Vanadium	22/- per lb.	
,, Molybdenum	10/- per lb.	
,, Titanium (carbon free)	1/6 per lb.	
Nickel (per ton)	£190	
Cobalt	15/- per lb.	
Aluminium (per ton)	£150	

FUELS [10]

	SCOTLAND.	Export.
LANARKSHIRE—		
(f.o.b. Glasgow)—Steam		40/-
,, ,, Ell		42/6
,, ,, Splint		45/- to 50/-
,, ,, Trebles		42/6
,, ,, Doubles		40/-
,, ,, Singles		39/-
AYRSHIRE—		
(f.o.b. Ports)—Steam		35/6
,, ,, Splint		40/-
,, ,, Trebles		32/-
FIFESHIRE—		
(f.o.b. Methil or Burntisland)—Steam		40/- to 45/-
Screened Navigation		50/-
Trebles		42/6
Doubles		40/-
Singles		37/6
LOTHIANS—		
(f.o.b. Leith)—Best Steam		40/-
Secondary Steam		37/-
Trebles		40/-
Doubles		39/-
Singles		38/-
	ENGLAND.	
[10] N.W. COAST—		
Steams		45/- to 49/-
Household		56/6 to 60/-
Coke		56/-
NORTHUMBERLAND—		
Best Steams		43/- to 45/-
Second Steams		40/- to 41/-
Steam Smalls		13/- to 17/6
Unscreened		30/- to 35/-
Household		36/- to 40/-
DURHAM—		
Best Gas		40/- to 42/6
Second		35/- to 37/6
Household		36/- to 40/-
Foundry Coke		55/- to 60/-
SHEFFIELD—[11]		
S. Yorks. Best Steam Hards		33/2 to 33/8
Derbyshire Hards		32/8 to 33/2
Seconds		31/8 to 32/2
Cobbles		31/8 to 32/2
Nuts		31/2 to 32/2
Washed Smalls		28/8 to 30/2
Best Hard Slacks		20/- to 25/-
Seconds ,,		20/- to 23/-
Soft Nutty ,,		20/- to 25/-
Pea ,,		18/- to 22/-
Small ,,		15/- to 18/-
House, Branch		40/2 to 40/8
,, Best Silkstone		36/8 to 37/2
Blast Furnace Coke		(45/-, 55/- export)
CARDIFF—	[12]SOUTH WALES.	
Steam Coals:		
Best Smokeless Large		45/- to 46/-
Second ,, ,,		42/6 to 45/-
Best Dry Large		42/6 to 45/-
Ordinary Dry Large		42/6 to 43/6
Best Black Vein Large		45/- to 47/6
Western Valley ,,		42/6 to 45/-
Best Eastern Valley Large		42/6 to 45/-
Ordinary ,, ,,		40/- to 42/6
Best Steam Smalls		25/- to 27/6
Ordinary ,,		17/6 to 22/6
Washed Nuts		42/6 to 47/6
No. 3 Rhondda Large		47/6 to 50/-
,, ,, Smalls		35/- to 37/6
No. 2 ,, Large		40/- to 42/6
,, ,, Through		35/- to 37/6
,, ,, Smalls		17/6 to 20/-
Coke (export)		60/- to 65/-
Patent Fuel		42/6 to 45/-
Pitwood (ex ship)		37/6 to 40/-
SWANSEA—		
Anthracite Coals:		
Best Large		57/6 to 60/-
Seconds		55/- to 57/6
Red Vein		55/ to 57/6
Big Vein		55/- to 57/6
Machine-made Cobbles		67/6 to 72/6
Nuts		70/- to 72/6
Beans		60/- to 65/-
Peas		42/6 to 47/6
Breaker Duff		15/- to 17/6
Rubbly Culm		22/6 to 25/-
Steam Coals:		
Large		45/- to 47/6
Seconds		40/- to 45/-
Smalls		17/6 to 22/6
Cargo Through		37/6 to 40/-

[1] Delivered. [2] Not Makers' works. [3] At furnaces. [4] Glasgow, Lanarkshire and Ayrshire. [5] Home Prices—All delivered Glasgow Station.
[6] Export Prices—F.O.B. Glasgow. [7] Prices represent the real market before the *official* change was made. [8] These prices are practically alike now.
[9] Sheets reduced while other prices are advancing. [10] Except where otherwise indicated coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. [11] For inland sales. [12] Per ton f.o.b.

French Engineering Notes.

(*From our Correspondent in Paris.*)

Reparation.

THE recent negotiations between the Minister of the Liberated Regions and the representative of the German Government for the partial payment of the indemnity in material necessary for reconstruction is regarded with strong disfavour by manufacturers, who are protesting vigorously against the devastated areas being inundated by German products. The report that Germany has undertaken to supply hundreds of locomotives and several thousands of wagons has been explained by the official statement that the rolling stock is simply surrendered to replace that captured by the Germans; but that does not lessen the grievances of wagon builders, who have been very busy until lately upon repairs and are now faced with the prospect of being deprived of work altogether. The railway companies have stated that they are quite prepared to give out orders for wagons if builders will fix a reasonable minimum price based upon the prices asked by German firms, by which is probably meant a relative basis after taking into account the much higher cost of fuel and wages in this country. The attitude of the railway companies is the same as that of all classes of buyers, and even of the Minister of the Liberated Regions, who are of the opinion that the prices of manufactured products have not come down to anything like the extent that would seem to be justified by the decline of raw materials. Undoubtedly this insistent pressure upon manufacturers to quote lower prices is due to the German offers for reparation work which have established a basis far below what the French can accept, and, as it appears certain that prices must come down there is a good deal of agitation for the repeal of the eight hours' day in its present form, which is regarded as mainly responsible for the decreased output and higher productive costs. It is argued that the eight hours' day should be modified and adapted to the requirements of the different industries. Meanwhile, there is no alternative but to accept some of the German offers if the work of reparation is to be carried out more rapidly than is being done at present, and manufacturers therefore find themselves strangled by the huge war stocks that are still glutting the market and by the low prices at which the Germans offer to work on account of the reparation indemnity. French manufacturers are urging that the work of reconstruction should be left in their hands, and that if the indemnity can only be partly paid by material it should be utilised for the development of the colonies. The point is that the reparation funds are insufficient to permit of the work being carried out without the aid of German material.

Power Alcohol.

The State monopoly of alcohol was established on the principle that the spirit for human consumption should be so heavily taxed as to permit of alcohol being sold at low prices for industrial purposes. As a social measure it was generally approved, and there were hopes that the supplying of cheap power alcohol would remove the difficulties created by the high price of petrol. So far neither of these hopes has been realised. The State has become the sole buyer and distributor of alcohol, and the original idea of subordinating the revenue from taxes to the prosperity of industries using power alcohol has evidently not been followed out, for the distillers are complaining of the arbitrary way in which the State is fixing the prices it will pay for the spirit, and some firms have even found it necessary to transform new distilleries they were building in order to adapt them to other purposes. It is certain that, despite the promises of Government to supply alcohol under such favourable conditions that it would become a "national fuel," little or nothing has been done to encourage the use of the spirit for power purposes.

British Coal.

The statement that British coalowners have decided to export fuel to this country at prices representing a reasonable advance upon those ruling before the war has created a good impression amongst consumers, who were beginning to express some uneasiness as to the future of coal supplies. It appears fairly certain that Germany will make the most of her own alleged shortage due to the falling off in the production in Upper Silesia to reduce the consignments to France, and there is also the perpetual fear of strikes in the Ruhr basin which will deprive this country of German coal. Consumers have long been hoping that any deficiency would be fully made up for by shipments from the United States, where the coal companies have been making strenuous efforts to develop a European trade, even to the extent of creating huge stocks in different parts of the Continent. It is argued that the freights are of small importance in view of the cheap extraction of coal in the States, but when the wholly insufficient return freights are considered it is obvious that the carriage must be a serious factor. There have also been many complaints of the quality of the American coal, and those who had looked to the United States as a means of solving the coal problem are beginning to lose confidence.

Ferro-concrete.

Although a good deal of ferro-concrete work is being carried out, especially in the devastated areas, its employment is far less general than might have been expected in view of the recent high prices of steel sections. Most of the big constructions are metallic, and the use of ferro-concrete for buildings is becoming rather an exception. This is apparently due to the relatively high prices of concrete constructions, which have not come down in the same proportion as steel. The steel rolling mills have been obliged to allow such big reductions in the prices of girders and other sections that metallic buildings have come again in favour, and ferro-concrete firms will probably find it difficult to make headway against this preference for steel.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

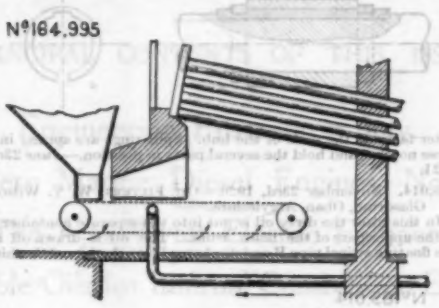
The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

STEAM GENERATORS.

164,995. August 17th, 1920.—FORCED DRAUGHT FURNACES, A. Knoepfel, Küsnacht, near Zurich, Switzerland.

To permit the consumption of very fine coal containing a large proportion of slack on chain grate stokers the inventor introduces a blast of heated air by means of a pipe running across the furnace beneath the chain. The air issues from the pipe

N°164,995



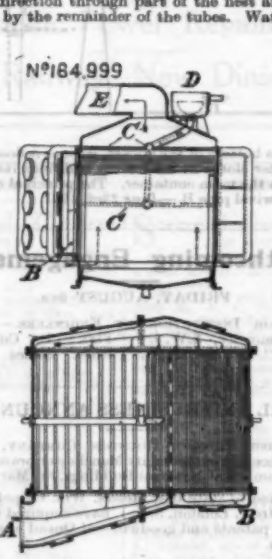
through a narrow slot. It seems, he says, necessary that an excess of air should be present, at a perfectly definite and definable moment, at approximately the place where the gasification zone merges into the combustion zone; otherwise imperfect combustion will result.—*June 23rd*, 1921.

CONDENSERS AND FEED-WATER HEATERS.

164,999. September 17th, 1920.—EVAPORATIVE SURFACE CONDENSERS, Sir W. Beardmore and A. Galbraith, Naval Construction Works, Dalmuir, Dumbarton.

This condenser is primarily intended for locomotive service. In it the exhaust steam, entering at A, traverses the horizontal tubes in one direction through part of the nest and returns to the hotwell B by the remainder of the tubes. Water is sprayed

N°164,999



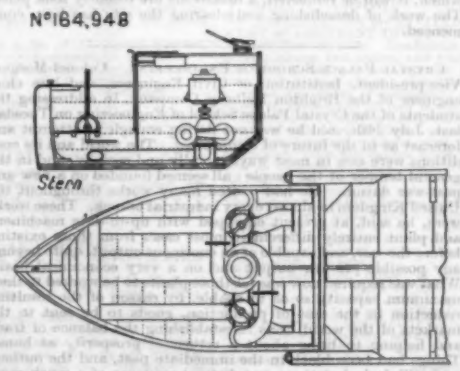
over the tubes from pipes C C, which receive their supply from a syphon tank D. The supply is intermittent and is so proportioned that all the water is evaporated off the tubes before a fresh spraying takes place. A draught of air is drawn over the tubes by a fan connected with the trunk E.—*June 23rd*, 1921.

SHIPS AND BOATS.

164,948. September 7th, 1920.—CANAL BARGES, A. Barham, 64, Tividale-road, Burnt Tree, Tipton, Stafford.

According to this specification canal barges should be made in

N°164,948



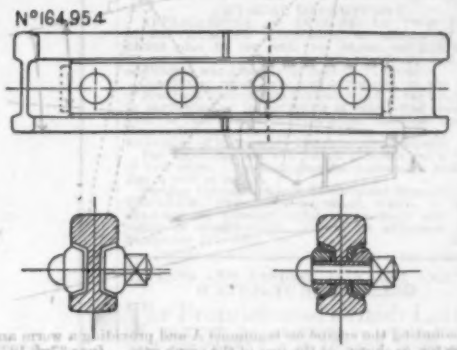
two pieces. One piece would be used solely for carrying the cargo, while the other, shown in the illustrations, would be devoted to the propelling machinery. Each piece would be capable of floating separately and they would be joined, while at work, by the bulkheads of the two butting together. Projections would be formed on the sides of the cargo lighter to embrace the machinery hull, and the two would be lashed together with ropes. The illustration shows propelling machinery of the water jet type, driven by an electric motor drawing its supply of current from an overhead wire.—*June 23rd*, 1921.

TRAMWAYS AND RAILWAYS.

164,954. May 25th, 1920.—INSULATED RAIL JOINTS, T. Hardiman, 74, London-road, and T. J. Wheeler, 32, Park Fields, Chippenham, Wilts.

With the object of improving the wearing qualities of the rubber used for insulating rail joints for track circuiting purposes, the inventors vary the elasticity of the rubber according to its position with regard to the rail. That part of the insulation

N°164,954



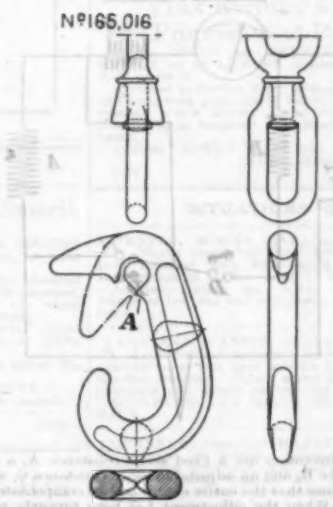
lying between the fish-plate and the web of the rail is hard in comparison with the edges, which come under the head of the rail. The face of the rubber, also, is softer than the main body of the sheet.—*June 23rd*, 1921.

CRANES AND CONVEYORS.

165,016. December 16th, 1920.—SWIVEL CARGO HOOKS, The Scottish Stamping and Engineering Company, Limited, Neptune Works, Ayr, and J. G. Latta, Failford, Mauchline, Ayr.

In order to obviate the uncertainty and difficulty of the usual welded joint in the eye of cargo hooks the inventors form the hook as shown by the full lines in the drawing and close the

N°165,016



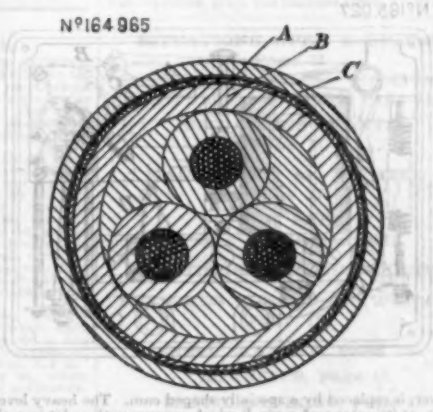
opening, by bending, after the swivel is put in place. It is suggested that the two lugs A A may be spot welded. In any case the section of the hook at its smallest part is sufficient to carry the load.—*June 23rd*, 1921.

ELECTRICAL APPLIANCES.

164,965. June 19th, 1920.—TESTING FOR FAULTS, L. R. Lee, Ash Villa, Mobberley, Cheshire.

In order to discover the leakage of moisture through the outside sheathing of electric cables the inventor winds strips of

N°164,965



two dissimilar metals A, such as copper and zinc, round the cable outside the main insulation B and inside the sheathing C. The strips are surrounded by hygroscopic material. If water penetrates the sheath a potential difference is set up between

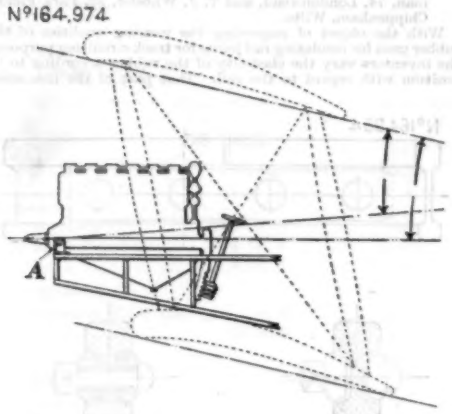
the strips and is indicated by an appropriate instrument at any convenient place.—*June 23rd*, 1921.

AERONAUTICS.

164,974. July 2nd, 1920.—VARYING THE ANGLE OF INCIDENCE OF AEROPLANE WINGS, K. F. Brackenbury, 20, Prince of Wales-road, Battersea, London, S.W. 11.

The inventor proposes to vary the angle between the centre line of an aeroplane propeller and the chord of the wings by

N°164,974.



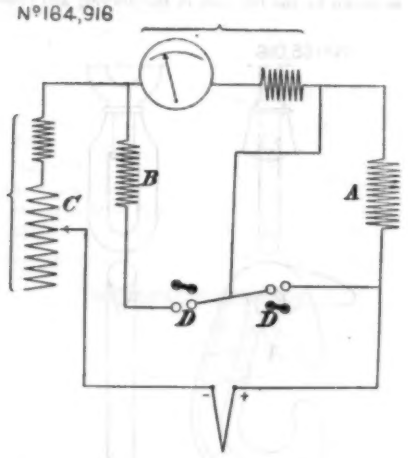
mounting the engine on trunnions A and providing a worm and sector, as shown, at the rear of the crank case.—*June 23rd*, 1921.

MEASURING AND TESTING INSTRUMENTS.

164,916. April 15th, 1920.—THERMO-ELECTRIC MEASUREMENT OF TEMPERATURE, F. Rowcliffe, 208, Chesterton-road, Cambridge, and the Cambridge and Paul Instrument Company, Limited, Cambridge.

It is desirable that the circuit of thermo-electric temperature recording instruments should have as little resistance as possible, in order that a robust form of galvanometer may be used. Such a circuit, however, has a high temperature coefficient, which introduces errors in the readings. In order to overcome this

N°164,916



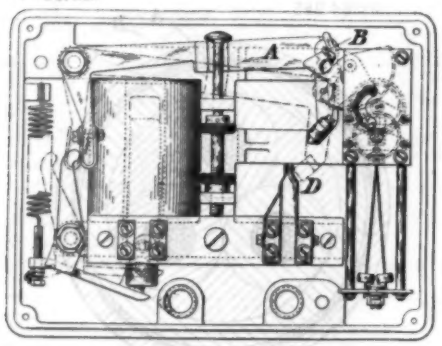
difficulty the inventors use a fixed series resistance A, a fixed shunt resistance B, and an adjustable series resistance C, which are of such values that the entire circuit can be compensated by adjusting C. When the adjustment has been properly made, closing the switches D D should not affect the reading of the galvanometer.—*June 23rd*, 1921.

SWITCHGEAR.

165,027. February 9th, 1920.—TIME LIMIT RELAYS, A. Reyrolle and Co., Limited, and B. H. Leeson, Hebburn-on-Tyne, and J. Mirrey, Nyong, Sunderland-road, East Boldon, Durham.

In this time limit relay the mutilated toothed sector, which is employed in some types to control the movement of the actuating

N°165,027



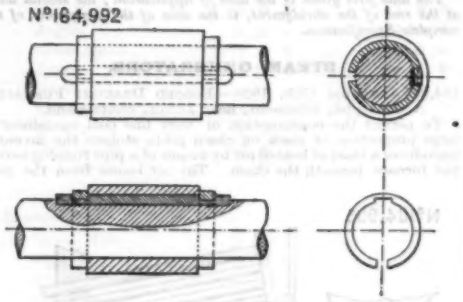
lever, is replaced by a specially shaped cam. The heavy lever A has, at its outer end, a pin B which engages with a slot in a plate C. Teeth on this plate drive the first member of a clockwork movement that controls the rate of movement of the lever. When the plate C has been rotated through a predetermined angle, by the weight of the lever, the pin B comes out of engagement with the slot. The lever is then free to fall and strikes the contacts D of the trip circuit. The apparatus resets itself. —*June 9th*, 1921.

MISCELLANEOUS.

164,992. August 11th, 1920.—KEYS, P. Harivesu, 21, Rue de la Source, Paris.

In order to fix the hub of a wheel on to its shaft the inventor uses one or more normal keys, which have notches cut in their

N°164,992

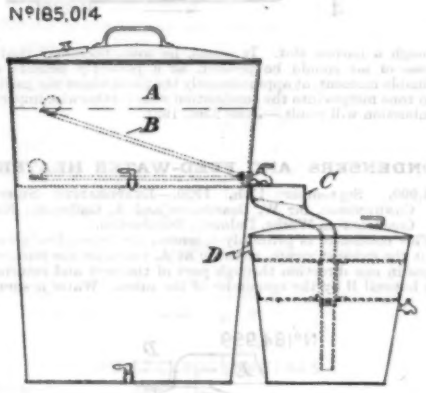


outer faces at the ends of the hub. Split rings are sprung into these notches and hold the several parts in position.—*June 23rd*, 1921.

165,014. November 23rd, 1920.—OIL FILTERS, W. T. Wilson, Glasdrum, Oban, Argyleshire.

In this filter the dirty oil is put into the separate container A in the upper part of the main drum. The oil is drawn off by the floating swivel pipe B and discharged into the funnel C, which

N°165,014



loads it to the bottom of the bucket, whence it floats up through water and filter cloths in the bucket and finds its way, by the outlet D, into the main container. The principal claim concerns the floating swivel pipe B.—*June 23rd*, 1921.

Forthcoming Engagements.

FRIDAY, AUGUST 5TH.

THE JUNIOR INSTITUTION OF ENGINEERS.—39, Victoria-street, Westminster, S.W. 1. "Flax: Its Cultivation and Manufacture," by Mr. C. R. Turner. Slides and exhibits. 8 p.m.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

THE BRITISH THOMSON-HOUSTON COMPANY, Limited, of Rugby, has recently extended its Manchester branch by securing additional premises at National Buildings, St. Mary's Parsonage.

WE are asked to state that Messrs. Wm. Geipel and Co., 72a, St. Thomas-street, London, S.E. 1, have acquired the business—stock, plant, patents and goodwill—of Quead electric fires, as a going concern.

REAVELL AND CO., Limited, of Ipswich, ask us to state that their works will be closed from 5.30 p.m. to-day until Monday, August 8th, at 8 a.m. During that period no goods will be dispatched or accepted at the works.

WE are asked to state that British Thomson-Houston magnetos were fitted to the "Bamel" machine, Mars I., piloted by Mr. J. H. James; the S.E. 5a machine, flown by Flight-Lieut. W. H. Longton; and to Mr. A. S. Butler's Bristol "Tourer," which secured respectively first, second, and third places in the Aerial Derby on Saturday, July 16th.

G. J. PALMER AND SONS, of 10, High-street, Poplar, London, E. 14, have purchased the fire salvage, together with the machinery as it stands at the premises of Dolton, Bournes and Dolton, Limited, timber importers, Archangel Wharf, New Cross, at which, it will be remembered, a disastrous fire recently took place. The work of demolishing and clearing the site has been commenced.

CRYSTAL PALACE SCHOOL OF ENGINEERING.—Colonel Morgan, Vice-president, Institution of Civil Engineers, and late chief engineer of the Brighton Railway Company, in addressing the students of the Crystal Palace School of Engineering on Tuesday last, July 26th, said he was not daring enough to attempt any forecast as to the future of engineering. The world and its conditions were new in most ways morally and socially, and in the general temper of the people; all seemed founded on a new and post-war datum. He had visited many works throughout the United Kingdom in almost every industrial branch. These works were, he said, at present equipped with up-to-date machinery and plant entirely different in most cases from those existing before the war, and capable of an enormous output, quite beyond any possible pre-war output and on a very economical basis. What was required now was for those plants to be worked to their maximum capacity so as to enable, by reason of the resulting reduction in the cost of production, goods to be sent to the markets of the world, thus re-establishing the balance of trade and helping to bring about a return of prosperity at home. Things had been black in the immediate past, and the outlook was still dark, but there was distinct evidence of a much more reasonable and tolerant feeling all round between the employers and employed, and it led him to the conclusion that they had turned the corner of depression and were on the upgrade to a happier and more stable condition of affairs.

CATALOGUES.

PETTERS, Limited, Yeovil.—Publication No. 561 illustrates and describes Petter Junior oil engines.

H. MUNZING, Limited, 90–96, Union-street, Southwark, S.E. 1.—Catalogue No. 61 deals with pipe fittings.

UNIVERSAL DRAFTING MACHINE COMPANY, Cleveland, Ohio.—Illustrated list of the Universal drafting machines, with examples of their application.

E. G. APPLEBY AND CO., Limited, 70, Victoria-street, S.W. 1.—Illustrated catalogue dealing with the "Phœnix" patented electro lifting magnet.

HAY, MARYON AND CO., Limited, 14, Bride-lane, Ludgate-circus, E.C. 4.—Illustrated catalogue dealing with water power and hydro-electric plant.

C. A. PARSONS AND CO., Limited, Heaton Works, Newcastle-on-Tyne.—Pamphlet No. 3 deals with the application of Parsons' steam turbines to paper mills.

CRESSALL MANUFACTURING COMPANY, 40 and 41, Stainforth-street, Birmingham.—List No. C R deals with "Cressall" controller resistances for cranes, lifts, hoists, &c.

SULLIVAN MACHINERY COMPANY, Chicago, U.S.A.—Bulletin No. 78 A deals with Sullivan dry vacuum pumps, single-cylinder, steam and belt-driven classes WA 61 and WG 61.

W. J. BITHELL, Limited, Whitehall House, 29–30, Charing Cross, S.W. 1.—Illustrated pamphlet dealing with automatic grabs of which Messrs. Bithell are the sole licensees.

BRITISH INSULATED AND HELSBY CABLES, Limited, Prescot, Lancashire.—Pamphlet No. P 170 dealing with Prescot insulating varnishes. Pamphlet P 167 deals with paper insulated cables.

JOHN MILLS AND CO., Railway Foundry, Llanidloes, Montgomery.—Illustrated list of standard 8in. and 10in. self-contained haulage engines and spare parts. All the parts are standardised.

MILLARS' TIMBER AND TRADING COMPANY, Limited, Pinners' Hall, Great Winchester-street, E.C. 2.—Coloured folders which deal with steam concrete pavers and Millars' Cummerasphalt plant.

GENERAL ELECTRIC COMPANY, Limited, Magnet House, Kingsway, W.C. 2.—Bulletin No. 10 deals with the condenser system of protection against surges. Many illustrations are included.

JOSEPH SANKEY AND SONS, Limited, Hadley Castle Works, Wellington, Salop.—Illustrated catalogue dealing with steel storage bins. They are so constructed that they can be built up to fit in where they are required.

LEATHERS COMPANY (ALTRINCHAM), Limited, Grafton Works, Altrincham, Manchester.—This booklet deals with hydraulic leathers. Much information is given on the working and care of hydraulic leathers and machinery.

H. J. SKELTON AND CO., Limited, Royal London House, Finsbury-square, E.C. 2.—Particulars of revised British standard rolled steel sections extracted from the British Engineering Standards Association Report No. 1, 1920, revised.

BROWN BROTHERS, Limited, Great Eastern-street, E.C. 2.—Illustrated pamphlet dealing with the Duco spring gaiter; also illustrated booklet dealing with Duco patent leaf spring gaiters, an appliance for lubricating and protecting motor car springs.

RUSTON AND HORNSBY, Limited, Lincoln.—Catalogue No. 4078 deals with cold-starting oil engines. The Ruston airless injection cold-starting oil engines are made in many sizes from 15–340 brake horse-power. Many illustrations of plants running are given.

THOR ELECTRIC SAFETY LAMP COMPANY, Limited, Thor Works, Rea-street South, Birmingham.—Illustrated catalogue dealing with the "Thor" electric miners' safety lamp. There are also other types of lamps made under the same patents suitable for other purposes.

WATTS, FINCHAM AND CO., Limited, Billiter Buildings, 22, Billiter-street, E.C. 3.—This is a comprehensive catalogue of the many departments of Messrs. Watts, Fincham. The catalogue deals with machinery, tools, and general stores for engineers, mines, steamships, railways, &c.

BULLIVANT AND CO., Limited, 72, Mark-lane, E.C. 3.—Illustrated catalogue dealing with steel wire ropes and accessories. An illustrated article covers several pages dealing with the "salvage of the block ships sunk at Ostend and Zeebrugge during the naval raids on those bases."

MOSSAY AND CO., Limited, 7, Princes-street, Westminster, S.W. 1.—An illustrated brochure entitled "Industrial and Municipal Transport," which discusses the Orwell electric vehicles, of which Messrs. Mossay are the selling agents for Ransomes, Sims and Jefferies, Limited, Ipswich.

GEORGE ELLISON, Perry Barr, Birmingham.—List No. 17 deals with totally enclosed air break "Mill" type circuit breakers. List No. 19 deals with trailing cable socket and plug fittings for the "Mill" type circuit breakers, suitable for direct and alternating current circuits up to and including 650 volts. Prices are included in both the above lists.

VAUGHAN CRANE COMPANY, Limited, Openshaw, Manchester.—Illustrated catalogue dealing with the following subjects of hoisting machinery:—Electric overhead travelling cranes, blocks and trolley hoists, overhead runway systems, block wall jib cranes, electric or belt-driven self-landing hoists, hand power overhead travelling cranes, pulley blocks and trolleys for overhead runways, overhead runway systems, and pulley block wall jib cranes.

A. RANSOME AND CO., Limited, Stanley Works, Newark-on-Trent.—Illustrated catalogue of cooperage machinery, which consists of 138 pages, giving particulars of all kinds of machinery for manufacturing casks, barrels and firkins. Besides an alphabetical index, there is given a classified index of cooperage machinery. The catalogue is a complete treatise on the subject, and considers the entire question of the mechanical manufacture of casks and barrels from the rough material to the completely finished article.

HENRY WALLWORK AND CO. (1920), Limited, Roger-street, Manchester.—Illustrated catalogue dealing with the Wallwork worm gear drives. The subject is dealt with in many pages entitled "High Efficiency Gearing: Its Application, Design and Testing." Catalogue which deals with the subject of "Wallwork" gear generators. In addition to the description many illustrations are included. Leaflets dealing with "Wallwork" worm gears, "Wallwork" enclosed back gear, "Wallwork" worm geared winch, and "Wallwork" worm and spur gears.

METROPOLITAN-VICKERS ELECTRICAL COMPANY, Limited, Manchester.—A pamphlet entitled "Education for Industry" has been compiled and issued by the above-named company's education department. The facilities which the company provide for the education of apprentices is set forth. Special publication 7783/2. Illustrated catalogue dealing with electric arc welding. Instruction book 5370/1, dealing with the installation and operation of Metropolitan-Vickers power transformers. Special publication 7840/2 deals with the electrical drive and control of machine tools. Many illustrations are included, with the descriptions of plant.